ECONOMICS OF GROWTH

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ASIA PUBLISHING HOUSE
BOMBAY • CALCUTTA • NEW DELHI • MADRAS
LUCKNOW • BANGLORE • LONDON • NEW YORK

Jamshed Kaikhusro **Mehta** (1901)

SBN 210.31183.5

PRINTED IN INDIA
BY B. K. BHARGAVA AT SARAL PRINTING PRESS, KAISER BAGH, LUCKNOW
AND PUBLISHED BY P. S. JAYASINGHE, ASIA PUBLISHING HOUSE, BOMBAY

PREFACE TO THE SECOND EDITION

THE BOOK has been revised and enlarged. The new chapters are Cycles and Growth: Their Relationship and Mutual Convertibility (chapter 18 in this edition), Commonsense of Full Employment Growth Rates (chapter 19), and A Resume of Modern Thinking on Growth (chapter 20).

It is sometimes believed that cycles and growth are absolutely unrelated, isolated phenomena. How they are conceptually and practically interrelated is shown in chapter 18. The importance of time-lags has been clearly brought out and it is argued that there can be no cycles in a timeless system. But time itself is a creation of the human mind. a timeless system can be converted into that with time-attribute by altering the unit of time. Time has no natural unit; it is the human mind that invests it with quantitative attribute.

Since time plays such an important part in our study of cycles, the principle of causation comes into the picture. How it does is also shown in this chapter. How growth and cycles are convertible phenomena is explained in the section entitled Recursive Models and Time-lags. The importance of the multiplier and the accelerator in the study of cyles is well known. How the time-lags related to these phenomena can have neutralising effect is explained in this chapter.

What are the causes of growth? What is logical meaning of full employment? What is full employment in macroeconomics? These are some of the questions the answers to which will be found in chapter 19. We have no very satisfactory definition of full employment in a macroeconomy; but certain indications of full employment in a practical sense are given in this chapter. We also read here how full employment can, in certain circumstances, be increased to *fuller employment.* After full employment of factors income can grow where fuller employment is possible to effect. Thereafter we can have growth only when factors of production themselves grow.

But the growth of factors of production can be autonomous or induced: their growth may be endogenous or exogenous in character. It is generally believed that population exhibits growth that

is mostly autonomous in nature. Likewise, there are some who believe that capital too grows autonomously. It may be that in reality capital-growth is induced but that the inducement is cloaked by certain economic phenomena so that it makes us believe that capital grows endogenously rather than in response to the increase (or demand for increase) of income. Be that what it may, chapter 19 considers the cases of autonomous and induced growths of factors of production.

A brief summary of the main ideas of modern economists is given in chapter 20, entitled A Resume of Modern Thinking on Growth. Full justice cannot be done to the subject in a small chapter; I have merely indicated the lines on which economists have been thinking about growth in recent times. This will incidentally serve to fill the gaps that might be found in some of the earlier chapters. What is growth, why it becomes necessary to build a model of a growing economy and why it is felt necessary to pass on from a simple to a complex model are some of the questions answered in this chapter.

Equilibrium rate of growth is stable in a sense and it is for that reason determinable. It has its importance in theory, in the *science* of economics. Otherwise, its usefulness is limited; it is neither actual rate nor the natural rate. Equilibrium rate is the norm for actual rate. We must have norm, the actual is to be viewed and understood only with reference to the norm.

Something is said by way of comparison of mathematical and verbal analyses. The former makes a greater use of formal logic; mathematics is the logic of numbers. And then we read something about stability in this chapter.

With the little revision that has been made and the addition of the obove three chapters the book has become more comprehensive and should prove a useful and dependable textbook. Before I end this preface I wish to express my gratitude to my colleague Mr. R. N. Lohkar, who has read through the proofs and prepared the index at a moment's notice.

J. K. MEHTA

PREFACE TO THE FIRST EDITION

ECONOMICS OF Growth has been written with the object of providing a simple and yet strictly logical treatment of the theory of fluctuations and growth of national income. A student of this subject, reading the excellent books available to him, often gets lost in the intricacies of mathematical treatment which slowly begin to claim his exclusive attention. Mathematics, there is no doubt, is a very valuable tool of analysis but it should not be allowed to overshadow the economic phenomena which it is meant to analyse. For a serious student of growth it is necessary that his attention be not deflected from the basic problems of his subject or from the interrelationships of its constituent parts.

Mathematical analysis is indispensable for precision of thought but the temptation, while applying this analysis to our problems, to treat mathematics as an end in itself often proves too strong to be overcome. There is always a philosophy that lies at the bottom of a science and it is this philosophy that should be the concern of a serious student fully to comprehend.

It can be claimed for this book that it uncovers points of economic significance which do not lie exposed to the view of an average student of economics. To what extent the claim is justified will be revealed by the perusal of the pages that follow. Some of the important points brought out in the next are mentioned in the Introduction.

I have not listed the works of economists that I have admired and from which I have derived much benefit. My task has been to expose the unobvious side of dynamic economics and I have left it to the careful student to do the rest to understand and then to criticise.

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INTRODUCTION

MAN LIVES as much on the material provided by Nature as on the fruits of his own labour. He grows and prospers at the cost of other creations of God. With greed in his eyes he looks at them as His gracious gift to mankind. He scarcely realises that in His Kingdom all have an equal right to live and to enjoy His munificence. But man has gained a tyrannical control over all he surveys; with impunity he exploits his natural environments for his own use and he brings to bear on such a plunder of Nature human shortsightedness that ultimately leads to his own destruction.

With the least compunction, we capture and enslave the multitudinous beings that inhabit this earth. On their labour as also on their flesh we live, grow and multiply How shortsighted and innocently destructive of life is man! The natural scientist that makes an outrageous encroachment on the privacy of Nature and the social scientist that explores the psychological sphere of human existence, encourage man's plunderous attitude to wealth and provide him with means, fair or foul, to grow and to prosper.

The economist shares with other scientists the childish foolishness they bring to bear on the subject of their study. And so, here are we economists to study with complacency the theory of growth. A positive approach to the subject of growth has nothing to condemn it, but when the economist lends his approval to man's desire for accumulation of wealth he begins to enter the dangerous zone of value judgment

We have adopted a positive attitude to the study of growth problem in the chapters that follow. It is only in the concluding chapter that we have expressed ourselves on the moral side of the question of stability or growth. There we have shown what modifications would be called for in our models by the introduction of the ethical element in our analysis.

We begin with the observation that every biological organism strives to preserve itself. But added to this is its strivings for growth. Whether that is a noble instinct or not is beside the point. By virtue of its character as a self-sustained conglomeration of forces, it possesses the dual instinct for self-preservation and

growth. An economic system is similar to a biological organism in all its essentials. Its natural tendency is to survive and then to grow. Man is a part of that system and he shares with it its natural concern for this growth through survival. That explains the economist's interest in the problems of a growing economy The natural strivings of an economic system to grow, meet with opposition from the environments in which it functions, and this opposition creates problems which the economist makes a subject of his study.

In this effort to grow from within, an economy's self-aggrandisation expresses itself by stages. It is consumption on which survival depends; but consumption has to be preceded by production. This *means* of production works counter to the *end* of consumption and, therefore, involves sacrifice. When the positive contribution of consumption is just equal to the sacrifices involved, a balance is maintained that gives rise to the concept of self-preservation. When a surplus accrues, growth is the result.

For self-preservation and growth, an organism has to cooperate with, as well as fight, the forces of Nature. The battle is fought as much on the psychological plane as on the physical. The latter feature of the fight manifests itself in terms of physical results. Income grows or diminishes. But the psychological side of the struggle cannot be seen with our eyes though it can be imagined by the mind. Thought must precede action. Producers' and consumers' intentions that make up the psychological aspect of man's reaction to Nature constitute *ex-ante* part of an economy's operations; the results obtained that express themselves in terms of wealth and income make up the *ex-post* side. Our models of economic growth are, therefore, constructed in terms of ex-ante consumption and production functions. To obtain a solution we have to equate the ex-ante with the ex-post relationships, the actual must tally with the ex-ante if equilibrium has to be maintained.

But equilibrium itself can be bifurcated into ex-ante and ex-post. The economy of a country functions through producers and consumers, and of these the producers constitute the immediately-propelling force of the system. It is necessary for producers to be in equilibrium, and they are in equilibrium when their minds are at rest. A mind anticipates the future. Production is a process that has its culmination in future results. The mind that thus

finds it necessary to foresee the future is at rest when the outcome of its planning conforms to its anticipations. An economy is, therefore, conceived of as being in equilibrium when the ex-post results equal the ex-ante expectations. This is the ex-ante concept of equilibrium. The ex-post equilibrium picture consists in the equality of physical entities at one time with those at another. It is a temporal concept. The two types of equilibrium can differ but when an economy has stopped growing or fluctuating they merge into one. Static equilibrium finds its ex-ante and ex-post aspects tallying, harmonising with each other.

An economic model fixes its attention on ex-ante equilibrium. Whether an economy is stationary at a certain level or is trespassing that limit, the ex-ante concept of equilibrium can be applied to it for the solution of the problem. But what is this solution?

A solution consists in the *determination* of the values of variables. And determination consists in the discovery of a norm. A determined price or a determined rate of growth of income has no direct relevance to what actually exists in the phenomenal world. It is what constitutes a norm, an ideal. It is what is *tending to be.* There is nothing to solve, nothing to determine as far as the *actual* values of variables are concerned. They are, as it were, lying exposed before our physical eyes. But the norm towards which they are tending is hidden from our sight and it is this norm that we determine, it is this ideal value that we make an attempt to find. The solution of a problem, therefore, consists in determining the norm-values of variables.

All mathematical solutions of our models are directed to the determination of the norm of our entities. Thus, when we determine the equilibrium growth of income, for instance, we find out the norm of growth. Harrod calls that warranted rate of growth of income. And the ex-post counterpart of it is called the actual rate. There is a trio of growth rates. First, there is the ex-ante, the warranted rate, then there is the natural rate and, lastly, the actual rate. It is this last rate that is truly ex-post. The natural rate is, as it were, Nature's ex-ante rate. It is what the natural constituents of a system *want.* The framework within which the human mind functions is provided by the parametric constants of a system. And they are constants in the sense that they are exogenously given as far as the mind of man is concerned. The natural forces tend to work out their solution—

their equilibrium—which conforms to the concept of natural rate of growth.

The human mind and natural forces act and react on each other, now cooperating, now competing, and the outcome of that, manifested in tangible results, constitutes the actual rate of growth, the truly ex-post rate. All this will be found explained in the chapters that follow.

We are all becoming model builders today. We start with some assumptions about the behaviour of economic units. These are then cast in mathematical moulds (they are made to speak the language of mathematics) Once they are thus transformed, mathematics is allowed to have its way till the equations are simultaneously solved. The result, in terms of mathematical symbols, is reconverted into economic relationships. That is how we handle our material Physicists do the same thing. They take sound waves, convert them into light (radio) waves, let them travel in all directions, collect them at far off distances, and reconvert them into sound waves. That is what is done through transmitting and receiving stations. And our models have potentialities that are exploited with the help of mathematics. Here we have a demonstration of cooperation between two disciplines. It is, then, when two sciences meet that a moral lesson is learnt.

What is that lesson? The multiplier-accelerator models prove that for the equilibrium of producers' mind what is needed in the case of growing incomes, is a continuous increase of income by greater and greater absolute amounts. But income cannot grow at that rate *ad infinitum*. If income is growing, it follows that sooner or later disequilibrium must result. This is the lesson we learn. If we allow our income to increase we are bound to meet with disappointment. Better it is, therefore, that we do not let our income increase Given a choice, shall we not then prefer stability to growth?

But there can be stability at different levels. Due to frictions of all kinds, an economy attains equilibrium position before the factors are fully employed. This under-employment stability has to be jerked out of its snug corner. But what is under-employment due to? It is argued in this book that involuntary unemployment of factors is due to voluntary unemployment of money. There must be some voluntary act somewhere in the system; all employable units of all employable factors cannot remain involun-

tarily unemployed. Money is a factor of production for the reason that exchange of goods and services is an act of production. Money is a medium of exchange; it is, therefore, a factor of production. This wider concept of production is suited to the treatment of the problems of a money-economy. We must define every term in the widest possible sense; unless we do that we leave out of consideration things which demand our attention.

So when money gets voluntarily unemployed it throws other factors out of employment. There is a certain proportion in which factors are combined. The coefficients of production are elastic but only within limits. If some units of money choose to remain out of employment, the cooperating factors are forced to remain idle Voluntary unemployment of money is due to the maintenance of cash-balances Money is meant to move and circulate, and it is money by virtue of this function it performs. But when people do not use it as money, trouble starts If some labourers were to choose to remain idle, they would force unemployment on the cooperating factors The same happens when money is not put to its proper use. We have expressed the cause of under-employment equilibrium in this way to coordinate the various causes of unemployment. This is a novel way but a correct way of diagnosing the disease. But money has no mind, nor a will; it remain unemployed because its owner wants it to. Money's voluntary unemployment means its owner's voluntary decision to let it remain unemployed. To remedy the situation, we must change the ownership of money. Transfer money from the rich to the poor, to those whose propensity to consume is higher, and secure employment for money.

The words *stability* and *growth* raise the question of the precise difference between statics and dynamics. These words can be used in different senses in different contexts But there is a difference between them that maintains itself through their various uses. In Chapter 10, we have explained the nature of statics and dynamics in a way that will appear to be novel. The basic, structural importance of statical analysis is brought out there. Dynamics is dynamics by contrast with statics The idea of change has its roots in the notion of rest. A thing, a force, or an acceleration (of velocity), all tend to preserve themselves; it is in their nature to seek survival as much as it is in the nature of a living organism. The instinct of self-preservation connotes dislike of

change, though tacked on to it is the instinct to grow. But growth too wants to survive and it can do so by being allowed to perpetuate itself without change.

The above considerations highlight the fundamental importance of statics and statical analysis. We would, therefore, be reluctant to side with those economists who regard the static state of an entity as a special case of its dynamic state. To see absence of change lying quietly under the dynamic state of a variable, to see the dynamic as a piecemeal manifestation of the static, is to see the *one in the many*. This is borne out by the conclusion to which we reach when we study *some* dynamic models, namely, that for equilibrium of a system that is growing, income must continue to grow at a *constant* rate.

The difference between static and dynamic states revolves round the concept of time. In the static state or statical analysis, time tends to obliterate itself. In the dynamical analysis we experience *a state of being* by stages—broken up time-wise. The concept of passing on from one moment to another emerges, and our analysis proceeds period-wise. We can choose the length of the period at will. The nature of productive activity should determine the size of the period.

Production is a continuous process but the significant landmarks in it are spaced at finite intervals. These landmarks are the decision to produce, the incurring of investment expenditure or the placing of orders for capital-goods, receipt of the same, output of goods, their sale, receipt of income by factors of production, their expenditure, and so on. We, therefore, subject our analysis to period-wise treatment. Something is said about continuous analysis in Chapter 10. Continuous analysis tempts a mathematician; let him delight in its use. But perhaps continuous analysis robs production of one of its essential characteristics. It is, however, for the mathematician to decide which feature of production he will concentrate on and for what purpose.

One feature of production is that it is a roundabout process—one in which there is a stock of capital. Income *flows* out of it. Strictly speaking, there is no stock concept appropriate to consumption. Consumption dies, as it were, the moment it takes birth. The more production becomes differentiated from consumption, the more capital-stock it accumulates. Witness the case of an individual plucking fruits. That is production, but it has no

capital-stock to proceed with. Why? Because there is no yawning gulf proper separating production from consumption. Any way, capital accumulation is the feature of modern economies. We sometimes take account of capital-stock in our models, treating it as a determinant of investment. Otherwise, it is determined by income or its rate of increase. It is argued in this chapter that in the absence of miscalculations on the part of producers, capital accumulates at a natural rate, technically consistent with income. That being so, it should have no independent influence on investment. For equilibrium conditions, should investment, then, be treated as a function of capital-stock?

Just as one can stretch a model to include in it the influence of capital-stock, one can stretch it to include foreign influences also. An economy can be taken to be a closed system in which exogenous forces have no place. That is a device to simplify the understanding of the manner in which fundamental forces operate. But sometimes we open out a system to the influence of foreign economies. The model then contains another variable Imports and exports lend themselves easily for treatment. Import can be made a function of income and export can be treated as a constant. Import is treated as a part of consumption and, therefore, made dependent on income It is easy to handle it if we make it a constant quantity. We rob this variable of its variability

In this chapter, a model of an open economy is given. The conclusion is that greater the imports, greater is the rate of growth of income. This conclusion must be carefully interpreted. It does not imply that if our imports are greater than our exports, our national income increases at a faster rate. Mathematics is tricky, it maintains silence, does its work quietly, and when we do not understand its ways and misinterpret its message, it just smiles It never loses its temper, never laughs, we can observe a suppressed smile on its lips. Such is mathematics What does this conclusion imply? Remember, our models tell us how and at what rate income should increase to keep the producers in equilibrium. More than that they do not tell. So, if imports are in excess of exports, income must increase faster to fill the gap. It does not tell us that income will increase at such and such a rate. It only says that to keep the producers in equilibrium, the income should increase at such and such a rate Whether income would increase at that rate depends on so many other factors.

All our models are multiplier-accelerator models Some economists have expressed doubts on the practical importance of the accelerator. Empirical enquiries conducted by some have not revealed any acceleration effect of increased income or consumption on investment. But we cannot place implicit faith on such findings. To be dependable, the inductive method has to be applied with the utmost care. Investment decisions are taken by individuals, and an investigator has access to them. But the accelerator is a macro-concept, figuring in macro-dynamic models. If, therefore, empirical findings provide no evidence of the accelerator, one can understand it.

But why should we go to businessmen to be convinced of the fact that to produce income x we have to have capital-equipment worth more than x? Why should we go and ask a producer whether a machine costs more than the value of the output it produces per unit of time? If we know what a capital-good is we shall not need to make enquiries in the market place.

Is the acceleration coefficient the same thing as capital-output ratio? This point has been discussed in the chapter on "The Accelerator." We have shown there that the accelerator is psychological while capital-output ratio is technological in nature. But psychology does not hang by its own bootstrap. It has its roots in technological facts. The accelerator may differ from capital-output ratio but it cannot continue to be different from it. It must tend to conform to the capital-output ratio.

Go to the real side of the picture. What is the fundamental fact behind the accelerator? Acceleration is due to the fact that an economy has to work more than is necessary for immediate consumption. That is why there is no acceleration when factors of production are fully employed. How can one work more when one is already working to one's maximum capacity? It is good to go behind the surface facts to see what forces are operating there. Knowledge of surface facts is misleading; we economists must make our economy throw off its money-veil so that we can see the unveiled real facts which it is our ultimate object to see.

We have already observed that mathematical conclusions must be carefully interpreted. Our models show that as the acceleration coefficient increases, growth of income decreases. Does it not sound paradoxical? It does; but that is because we do not know how to understand and interpret our mathematical solutions.

The accelerator has to conform to the capital-output ratio. A higher value for the accelerator means a higher capital-output ratio which shows that the system needs more capital to produce a given income. When more real resources are thus used up in the production of goods, output must increase more slowly. The situation is one of low technical efficiency.

It is shown in this chapter that the motive force behind the accelerator is variation of the volume of cash-balances These are simple truths, but simple things are often the least obvious. For, they are so humble that they do not attract our attention. Broad and bold facts attract our attention, often capture our attention; but then we gain very little by being captivated by them. We scientists must hunt out those little, simple truths that lie hidden in the unfathomed bed of our ocean. So for these simple fundamental facts, one must read this chapter. There it is also shown how the multiplier exercises a check on the accelerator-coefficient by keeping the rate of growth of income down

Harrod is the pioneer in growth models but Domar is also there and their names are bracketed wherever growth models are studied. They both reach the same conclusion. And they must, for, truth is one and the same. One may adopt any method one likes, one may follow whatever path one chooses but one is bound to reach the same end End is one; and so Harrod and Domar reach the same final end. But the means they use are slightly different. Harrod makes use of the psychological acceleration-coefficient while Domar uses the technical capital-output ratio or the income-capital ratio In the final analysis they must tally. Human minds may make mistakes, they may think differently, may make faulty guesses about the future, but they cannot go on glorying in their mistakes. Truth is bound to assert itself and then the producers will have to make their psychological accelerator conform to the technological facts of life. And so when we are judging the end results—what would be the rate of growth of income in equilibrium—the two coefficients must be the same. That is why Domar gets the same result as Harrod. Remember, Harrod's supply equation is cast in ex-ante mould while Domar's is cast in ex-post mould. But the two must merge into one in the position of equilibrium. Equilibrium is defined by such an equality.

A common charge is levied against these two economists. Their

models are not dynamic. Are they not! May not be so in form but are so in their contents. The increment of income in Harrod's model is related to investment belonging to the same period. There is no time-lag. But the link between the past and the present is still there. Increment is a function of the past and the present and that preserves the link that binds the present to the past.

Domar gets credit for the *sigma effect*. Let us not grudge that. But the same effect is there in Harrod's model also. There the *sigma* is the inverse of *g*; the sigma effect wears a psychological mask. We repeat, the two economists approach the same end from two different angles. But there is no fundamental difference. Let their names, therefore, remain bracketed.

We take up next some other model. All the models have the same thing to tell us If we want income to fluctuate or to grow, we must operate on the psychological plane. There are factors of production which we can and must use for the production of goods. But their use is determined by the human mind. The importance of the psychological coefficients—the multiplier and the accelerator—lies there. They have their origin in the mind. If we want to change the flow of income, we must create forces to operate on the psychological plane of the economy. That underlines, incidentally, the importance that needs to be attached to the human element for the conduct of all economic affairs. It is not only man's stupidity that stands in the way of his progress, it is also the manner in which he behaves with his fellow brethren that determines his economic future. The psychology of one man is a function of the psychology of another, unless this psychology is changed and unless the relationship between one's way of thinking to that of another is altered, no amount of change in the physical framework of an economy can accomplish anything. The emphasis on the behaviour equations is rightly there in the models.

Duesenberry's models show that for continued rise of income, the economy should be willing to make sufficient provision for the future (through producers' investment) and then willing also to take advantage of the results of such a provision (through consumers' behaviour). Producers and consumers must work in harmony. In the final analysis their interests are common; for a macro-economy which is essentially a one-man economy, consumption and production are just two aspects of the same process. Our

understanding of a macro-economy is unfortunately via a network of micro-economies. If we could rise above the conflicting interests of these micro-economies and view the system in its entirety, we would see production serving consumption and consumption stimulating production. If we think philosophically, Duesenberry's models bring these facts to light

We can show that for steady growth of income, two conditions must be fulfilled. First, there should be no disturbing influence of exogenous forces and, secondly, that our attitude to the present and the future should be reasonable and rational. In other words, the consumption and investment coefficients should have values within a certain range. The first condition may be identified with God's grace; the second with our own attitude to our environments. For success we must do our part well, but that is not all. We cannot change our environments any way we like. There is a superior power and it has a function to perform. He is there and we have to depend ultimately on His grace. Otherwise, we would become our own master and usurp the powers and functions of that Supreme Being.

We have had something to say about the place of capital-stock in a growing economy. The inclusion of capital-stock in a model amounts to the breaking up of production into two stages and then their coupling together in one system. Production becomes more jerky, the flow of economic forces becomes uneven. Time-lags assume importance and life, as also our models, become complicated. In the chapter on "Other Models," we have something to say about all this in connection with Kalecki's model.

Our models contain some parameters and some variables. The former constitute the framework within which the latter operate. Our object is to determine the manner in which the variables vary or the values they assume in equilibrium. The former belongs to dynamic economics, the latter to static economics. And, as explained above, the two are related to each other. We can see the unchanging in the changing. Be that as it may, we have to find the values of our variables, whether they are constant or changing. If we start from an assumed position of equilibrium, how and why do the variables change? In the position of equilibrium, the variables have ceased to vary. If they begin to vary, what is the cause? It is argued in the chapter on variables that the cause is to be traced to some exogenous influence.

When our variable changes, the disturbance shifts itself till its incidence falls on all the variables of the system. This shifting will be more perfect in a system in which the various operating constituents are rigidly linked together. The shifting of the disturbance is analogous to the shifting of a tax. The manner and extent of the incidence of the variation of a variable depend on the nature of the disturbance (the way it operates) and the kind of relationship that exists between variables, i e. the values of the multiplier and the accelerator. We are concerned with this problem how and why do the variables of a system vary?

The extent to which variables can vary depends on factors that are natural and man-made The use of factors can go on increasing and that is one manifestation of the variability of variables. But once full-employment level is reached, what is it that varies? How does income vary then?

In the chapter on "Variables of a Dynamic System," an attempt is made to provide an answer. The question is linked up with that of measurement of factors. But assuming that factors are measured in the ordinary way by counting the physical units, we can argue that once all the factors are fully employed income can increase only through the improvement of technology. But the method of production is a function of organisation. Improved technique means improved organisation and *improved* organisation means *increased* organisation. This is explained in the chapter under review. If growth has to be sustained, if income has to be conceived of as increasing without limit, then we have to grant that organisation can increase without encountering a ceiling.

There are two ways in which organisation can increase. Either Nature may give us increasing amounts of organisation as and when we need it, or we might draw upon our stock of unemployed organisation which has to be inexhaustible if income has to keep on increasing. Which of these two ways operates in practice, we do not know. May be, the part that the invisible hand plays here is greater than we are wont to recognise.

Growth of income after full-employment can also be accounted for by the natural increase of population. But that would need to be an even increase at all the strata if it has to supply the economy with all the productive services needed for growth. If population increases more at the lower level than at the higher, it would upset the balance between labour and organisation (and

also, of course, enterprise and waiting). Income in that case would need for its continued increase elastic coefficients of production. But that means, again, a change in technique implying increase of organisation (organising ability).

All things considered, we have to be beholden to organisation for growth of income. It is maintained in this chapter that organisation has large hands and a small stomach. A labourer's capacity to produce surplus of income is narrowly limited; organisation is capable of producing surplus that staggers our imagination.

In the concluding chapter on "The Question of Choice," we investigate the nature of our final end. Provision has to be made for the end; knowledge of how to attain the end is needed. For that we need to make a positive study of economics. It is shown that the final end which is unconsciously, more than consciously, striven for is freedom from wants Its implications are examined and its relevance to growth of an economy indicated. Accepting the end as a rational one, it is shown how our models would be affected by its recognition. Policy implications of this end are then discussed. The chapter ends on a sober note. Better it is to live peacefully at a stabilised level of income than to make an attempt to raise it to a level that is inconsistent with human happiness. But we know, man will never learn this simple truth in such a simple way. It is, however, not our business to teach ethics to anybody, nor is it our intention to make people change their outlook on life. Our task is over when we have expressed ourselves without the motive of impressing others. As pure economists, we are *expressionists* rather than *impressionists*. Let it not be said of us that "they came to teach but stayed on to preach."

CHAPTER 1

THE ECONOMIC SYSTEM

THE MEANING OF "ECONOMIC SYSTEM"

ECONOMY AND economic system are two words that are often used as synonyms. Objectively their contents are the same There we find the factors of production consisting of natural resources called land, man-made resources called capital-goods, and man himself in his capacity as a labourer, a capitalist, an organiser and an entrepreneur. These together make up the objective picture of an economy or an economic system. Such a picture is a static picture, as it were. The mere coexistence of these productive resources gives rise to the concept of *economy*.

The term *economic system*, however, conveys by contrast a more dynamic picture. The factors of production work together, they cooperate for the production of wealth or national income. Their combined efforts directed to a common end give rise to a moving, dynamic concept of *economic system*. While the word *economy* denotes the material contents of a system, the term *economic system* connotes their functions, their cooperative efforts and their inter-relationships. The purpose of our study must, therefore, determine the choice of the word we use. In most contexts our preference will be for the more dynamic concept of economic system, for it is with the changing and adjusting aspect of an organic unit that we are mostly concerned. And yet much damage is not done when we use the two words as interchangeable.

THE PURPOSE OF AN ECONOMIC SYSTEM

An economic system operates as a system for the same reason for which a man functions as an organism. We all want to survive and we want to prosper; we want to safeguard our existence and we want to grow and develop. An economic system has the same wants, the same ends to pursue It wants to survive and it wants to grow. And it is these objectives that give meaning and purpose to the functions of an economic system. To talk in terms of

income, an economic system must produce sufficient income for its sustenance and, if possible, it must produce a surplus of income which may enable it to grow. The agents of production need a certain amount of income to live on. They spend their energy in the process of production—they spend themselves—and this must be recouped by the consumption of goods and services produced. If they could do that they would continue to survive. But they also want to prosper, to grow. And so they want to produce a surplus of income over their cost. This surplus enables them to grow. It is by virtue of such a surplus that an economic system develops, advances, expands or grows. The first and primary object of an economic system is, thus, self-preservation and its secondary object is self-aggrandisation, as it were.

These two purposes for which an economy functions as an economy have given rise to two related concepts of stability and growth. And the attention of the economist has been largely concentrated in recent times on the circumstances that favour or make possible stabilisation or growth of an economy When we say that an economy is growing we mean that it is producing a larger amount of wealth or income than is needed to repair the damage done during the process of production. The word *growth* has no moral or ethical implications though it *can* certainly have such an implication also. We talk only in terms of goods and services that people want to have, and abstract our attention from the moral and ethical aspects of such wants.

SELF-PRESERVATION AND SELF-AGGRANDISATION

We have said above that the object or the purpose of a system is to preserve itself, in the first place, and to expand or grow, in the second. Since income subserves both these aims, we can talk in terms of national income. A system lives on income and it prospers or grows by consuming more income than it needs for its sustenance. When it produces just sufficient income to live on, it remains in a stationary state; when it produces and consumes more than such an amount, it grows. It follows that if and when an economy produces less income than it needs for self-preservation, it must decline. Thus three states of an economy are imaginable. It is perhaps not possible to prevent the decline of an economy for ever. But it should be the endeavour of an

economy to postpone, as long as possible, the doomsday.

When an economy grows the surplus income produced by it is consumed and when that is done a new position is reached. The economy attains a grown-up stature and then for its survival at that level of growth it needs a larger amount of income than before. Henceforward a larger output of income becomes necessary to sustain the system at its higher level. Thus, the effort needed and the income necessary to sustain that effort increase as an economy grows. Thus, there are different levels of income that ensure a self-preserving economy; and in the same way, there are different amounts of surplus of income that are needed for self-aggrandisation.

THE CLASSICAL AND NEO-CLASSICAL INTEREST IN SELF-PRESERVATION AND GROWTH

When an economist thinks of a system, he automatically thinks in terms both of self-preservation and growth. The process of income-production is the same in both the cases. To survive, a system has to produce income and it is the same production of income that leads to growth if its tempo is accelerated. But our thoughts are rarely systematised to the extent to which they need to be to fully realise the above point. The classical economists talked in their own way of income-production. They considered the problems of maximisation of income and they knew that income can be made to increase by a proper utilisation of factors of production. They also considered in their own way the problem of increasing the production of wealth by increasing factors of production. But as must be expected, their analysis was elementary. Economics as a science was growing, and the process of growth had not come to an end. But the classical economists had understood the point that production of wealth could not only be maximised with a given stock of resources but that such a maximum level could also be raised by increasing the stock of productive resources.

The neo-classical economists concentrated their attention mainly on the problems of maximisation of wealth (income) with the use of given resources. They knew that to maximise production the available factors of production must be put to most economical use. And such use consisted in combining the factors in the

optimal proportion and seeing to it that no factor remained unused. In short, optimal allocation of resources yields the best results. The neo-classicals then developed their economics to subserve this end. What is needed is to maximise production, and for that the available, given resources must be combined in an ideal proportion. Each unit of each factor must be put to the best possible use.

Later economists began to think whether we should be concerned merely with the problems of best utilisation of given resources or also consider the possibility of increasing the supply of these resources themselves. Whether that was possible to do and, if it was, in what way such an increase of productive factors could be brought about were naturally pertinent questions.

Keynes, who perhaps for the first time emphasised and systematised the study of macro-economics, made his own contribution to the above problems. But he concentrated on the task of increasing the production of income to the maximum possible level with the given stock of resources His economics can be considered to be a kind of growth economics because he examined the ways of making a stationary economy grow. But his was not a full-fledged growth economics as he did not consider the possibility of increasing the quantity (or quality) of resources.

SELF-PRESERVATION AT VARIOUS LEVELS

Since self-preservation consists in maintaining a certain state of being, its object is to prevent a decline. But one can prevent a decline of an economy from various levels of existence. An economy can maintain itself with a little smaller or a little bigger national income. When some units of various factors are unemployed, national income is lower than what it would be were all the units employed. Both these levels of income can be perpetuated, i.e. prevented from falling. Technically speaking, we can say that it is possible for an economy to maintain a position of equilibrium with all the resources fully employed or with some resources unemployed. This consideration gives us four states of an economy. (1) An economy may be declining in the sense that it is producing a smaller and smaller amount of income. (2) An economy may be stationary or stable with available resources fully employed in the sense that it is producing the same amount of income per unit of

time and utilising all the given resources fully. (3) An economy may be stationary or stable with the available resources only partially employed in the sense that it is producing the same amount of income per unit of time and keeping some of its resources unused. (4) And, lastly, an economy may be growing in the sense that it is producing per unit of time an increasing amount of income. This last case is the one in which the economy is able to increase the supply of factors of production.

Keynes was concerned with explaining why an economy gets into the third of the above four states and how it can be lifted from it to the second state. This in itself was a contribution of sufficient significance. But economists since his time realised that it was possible for an economy to enter the fourth state mentioned above. That gave rise to what has come to be called post-Keynesian economics or growth economics.

CHAPTER 2

NATIONAL INCOME

As EXPLAINED in the last chapter we can conceive of two broad states of an economy, viz. stationary and changing. The former is characterised by the constancy of some entity of economic significance, the latter by its variability. There are many entities in respect of which the stationariness or otherwise of an economy can be judged; but it is useful to select one that has importance for the practical economist. An economy functions with the primary object of producing income. It is income, therefore, that is the index of its achievement, and we as practical economists should judge the state of an economy with reference to the behaviour of this particular entity.

CONTENTS AND MEASUREMENT OF NATIONAL INCOME

Having decided to measure national income in terms of goods we have next to decide whether it is to be measured by goods produced or goods consumed. Since both production and consumption take time, our measurement has to have reference to some time-interval. If a calendar year is selected as the appropriate period we can compute national income in terms either of goods produced or of those consumed in one year. But this distinction loses all significance when goods are looked upon merely as concrete, objective entities If we, however, regard them as embodiment of utility, some distinction of practical importance can perhaps be made between the two ways of computing income.

Goods produced within a period of time, considered as *produced*-goods have economic significance for those who have produced them. Hence, when national income is measured in terms of goods produced within a given period of time the computation can be said to be made from producers' point of view. In the other case, national income can be said to be measured from consumers' point of view.

The above statement is, however, not strictly correct. For, no precise line of demarcation can be drawn between producers and

consumers when a macro point of view is adopted. All men are producers and all men are consumers, provided we make an allowance for those who are unable to work In macro-economic discussions it is difficult to make out a significant difference between producers and consumers Yet some distinction can be made between producers' and consumers' points of view even in the case of a macro-economy. Goods are *first* produced and *then* consumed. Producers' point of view has, therefore, *precedence in time* over consumers' point of view. This time sequence is very important in other departments of economics also Witness here the distinction between ex-post and ex-ante approaches which has greatly assisted our understanding of economic phenomena.

PRODUCERS' AND CONSUMERS' POINTS OF VIEW FURTHER CONSIDERED

We have seen that national income can be measured in terms either of goods produced or of goods consumed. There is a temporal relationship between them; goods produced in one period are consumed in the next. This statement has to be understood with caution. For, as some goods take more time to produce than others consumption and production of goods (though not the same goods) go on simultaneously. Even so, the difference in terms of time sequence has a great conceptual significance, and something is certainly to be gained by keeping this distinction in mind.

Goods are of different kinds and different descriptions. To measure national income these have to be added up. Since things that are different in nature and description cannot be added up into a homogeneous lump, it becomes necessary to resolve all goods first into a common denominator. The denominator employed in economic computations is money. We evaluate all goods in terms of money. Unless we do that we get no significant measure—a measure that can be used to compare national income of one year with that of another.

Taking, then, the producers' point of view, national income consists of money-cost of production of goods. And since costs are composed of payments made to factors of production, national income can be computed by adding up the payments made to all the factors of production. Care has to be taken here that we add up not only the amount paid out but the amounts appropria-

ted also. In other words, we must add together all the remunerations earned.

Income thus calculated may be called national income from producers' point of view or national income as *factor costs*. When we compute income in this way it has naturally to be referred to the period of time that production of goods takes. It is, therefore, logically and conceptually related to a period that precedes the consumption of income.

When, however, we take consumers' point of view, national income consists of the value of goods consumed which, for purposes of ease of calculation, may be identified with the value of goods *bought* Income so measured from consumers' point of view is called national income as *value of output* Income in such a computation is referred to the period of consumption which logically and conceptually follows production of goods.

TWO WAYS OF COMPUTING NATIONAL INCOME AS VALUE OF OUTPUT

When national income is measured from producers' point of view it consists of the sum of factor-payments When it is measured from the point of view of consumers, it consists of the sum of seller-payments, i.e. payments made by consumers to producers. This mode of expressing income as payments made by consumers or buyers to sellers has one advantage. To understand this point, let us see how the value of goods bought is calculated. There are various categories of goods that are bought and sold. There are finished and semi-finished goods and there are raw materials and capital-goods. Are we to take the value of all these goods into account? If we add up the values of all these goods we commit the fallacy of multiple counting. For, to illustrate the point, the price of a finished good contains within it the price of raw materials of which it is composed. Hence, to get the correct figure of national income we must include in our computation the value of finished goods only. Or, and this is the other method of calculating national income from consumers' point of view, we may add up the *increments of value* of all the goods bought.

Thus, suppose a producer buys raw materials worth Rs. 100 and makes semi-finished goods which are sold for Rs. 150. The increment of value here is Rs. 50 which may be included in our computation. If the semi-finished goods bought for Rs. 150 are

turned into finished goods and sold for Rs. 200, the increment of value at this stage is Rs. 50 Thus, the total of all these comes to Rs. 200 (Rs. 100+Rs. 50+Rs 50). Where it is not difficult to distinguish finished goods bought by the ultimate consumers, the better thing to do is to include in our computation the value of finished goods only. When that is done, national income becomes the sum total of the payments made by consumers to producers. It is for this reason that we maintain, as said above, that national income can best be defined as the sum of payments made by consumers. When we look upon national income as the sum of such payments, its computation from consumers' point of view harmonises with its computation from producers' point of view. In the former case it is the total payments from consumers to producers, while in the latter it is the total payments from producers to consumers (that is, the factors of production). It becomes clear, when the two points of view are thus distinguished, that the difference relates to the period of time during which national income is produced We shall now see when national income from producers' point of view coincides with that from consumers' point of view.

WHERE PRODUCERS' AND CONSUMERS' POINTS OF VIEW COINCIDE

National income measured from the points of view of producers and consumers becomes equal when the payments made by producers to factors of production are just equal to the payments made by buyers to sellers. Or, to use a more common terminology, the two measures of national income coincide when the factor-cost of output and the value of output are the same. Now, when that is the case the economy is in some sense in equilibrium. For, the entire amount of money spent by producers finds it way back into their pockets. Here we must remember the equality is in terms of aggregates; money expended in producing raw materials, capital-goods, semi-finished goods and finished goods is equal to the total expenditure of the buyers of those goods. The equilibrium is in the economy as a whole. In the macro-economy there is no addition to or subtraction from the volume of money in circulation.

The equilibrium as defined above is more formal than real. Formal because in the market for individual goods there may not

be equilibrium, the expenditure and receipts may not necessarily be equal in all the sectors of the economy. Yet, since the equilibrium in the entire economy is there the income of one period just equals the income of the succeeding period. There is neither a surplus demand nor a deficient demand in the economy. One necessary condition for the attainment of equilibrium is thus fulfilled when national income measured from producers' point of view equals that measured from consumers' point of view.

What is a *necessary* condition of equilibrium in micro-economy becomes also *sufficient* condition for macro-economic equilibrium. But macro-economic equilibrium can be attained even when there is inter-sectional maladjustment The equilibrium is, therefore, more formal than real and offers no guarantee that the round of economic activities would exactly repeat itself This is the shortcoming of making a macro economic study of an economy that is in its nature and character, no less than in its operation, a micro-economy. Yet the formal analysis enables us to maintain that when the measure of national income from producers' and consumers' points of view coincide, one necessary condition of equilibrium is satisfied.

WHERE GOVERNMENTAL ACTIVITIES ARE CONSIDERED

In the above explanation of national income no specific mention was made of governmental activities. The government is also often a producer and a seller of goods and services. When a government sells goods and services in the same manner in which a private producer does, no complications are introduced in the technique of measuring national income. But a government often buys or produces goods and gives them to the people without charging a price. In such a case, it would appear, the payments made by the government to factors of production do not equal the payment made by consumers to the government To bring about the needed equality between the two measures of national income, we have to count the taxes paid by the public to the government as also their payments in their capacity as consumers to the government in its capacity as a producer. When the government finances its expenditure of the above type by taxes, no further care need be taken in computing national income. Nor is any complication introduced when a government borrows money to

finance the production or procurement of goods that are given away to the people without a charge For, even private producers borrow money to finance their expenditure on production. When, however, the budget of the government is not balanced, the two measures of national income differ. For, in that case, the income and expenditure of the government are not equal. The system is, then, truly in disequilibrium

There are times when a deliberate imbalance in government's budget is created to throw the system in a state of disequilibrium. When an economy, for instance, has settled down to an equilibrium position before all the factors of production have had a chance of getting employed, such a position of equilibrium has to be upset. Disequilibrium has to be created so that when the economy settles down to a new equilibrium position there might be fuller employment of resources. But more about this point later on.

NATIONAL INCOME AND CAPITAL-GOODS : DEPRECIATION

As we observed above, there are various categories of goods that are produced by a producer. Some of these are sold in the market for a price while others are used up in the act of production. Taking producers as a class, we can say that all capital-goods are retained by them for productive use while finished goods are sold to consumers. The costs of production of all the goods produced, which is the same thing as payments made to factors of production, when added up give us the measure of national income. And when there is equilibrium in the system this measure of income tallies, as shown above, with its measure from the point of view of consumers. National income as factor-costs equals, therefore, national income as value-of-output.

Capital-goods which are retained by producers for productive use wear out during the process of production. But there is no such depreciation in the case of finished goods which are sold for a price. The act of selling makes a change in the inventory but no change in the value of assets; assets in the form of goods are exchanged for those in the form of money. The composition of assets changes but not their value.

In the case of capital-goods used in production there is no such automatic process to maintain the value of assets intact. Their depreciation that accounts for loss of value has to be counter-

balanced by the maintenance of a depreciation fund. For that purpose the price of the commodity produced has to be sufficiently raised to enable the building up of the fund.

Here, then, we have a case of money that is taken from buyers of goods, which does not go into the pockets of factors of production. All other money received from buyers is spent by producers in making payments to factors of production. And that helps to maintain a continuous and smooth flow of money from consumers (buyers) to producers (sellers), and from there back again to consumers. The creation of depreciation fund causes a short-circuit in this circular flow of money, making national income measured from the points of view of consumers and producers unequal. National income computed from consumers' point of view exceeds that from producers' point of view by the amount credited to the depreciation fund. Hence, if national income is calculated by adding up the payments made by consumers or buyers to producers or sellers, depreciation fund must be deducted from it.

In the long run, however, such a discrepancy does not arise. For, when sufficient money accumulates in the depreciation fund it is utilised to replace worn out capital-goods. If capital-goods wear out at the rate of one machine in ten years, the funds accumulated in the depreciation fund during ten years have to be used to buy a new machine. Thus, at the end of ten years the money paid by buyers of goods in the past (to enable producers to build up the depreciation fund) finds its way back into their pockets. In this way, over a period of ten years the payment made by buyers to sellers equals that made by sellers to buyers (factors of production). The two ways of measuring national income once again yield the same figure.

A FINAL WORD ABOUT NATIONAL INCOME MEASUREMENT

To avoid all complications caused by depreciation and by government budget operations we should measure national income as the value of output, i.e. as payments made by consumers to producers during a suitable period of time. If we take a day for purposes of computation of national income, we would get a figure that has very little significance. Further, care has to be taken in calculating the value of output or the payments from consumers to producers; we must include in consumers those who are real

and final consumers In a way a producer of cloth is a consumer of cotton and the services of weavers. But he is not, in the sense relevant to our purpose, a consumer. It is for this reason that it is sometimes said that we should include in our computation the value of things that are outputs and not inputs.

Most of our difficulties here arise from the fact that we treat an economy as a macro-economy when it does not possess all the characteristics of a truly macro-economy. There would be no difficulty in the case of Crusoe economy as Crusoe is an indivisible whole and his is a true macro-economy.

We shall in the succeeding chapters judge the state of an economy by the level and fluctuations of its income as defined above National income is not the only index of stability or growth of an economy. For instance, employment of labour or of any other factor of production can be another index. But output measured in terms of money (neutral money) is perhaps the best of the available indices.

CHAPTER 3

CHANGES IN NATIONAL INCOME: FLUCTUATIONS AND GROWTH

TYPES OF CHANGE

IN THE last chapter we clarified the concept of national income and explained the ways in which it can be measured. In this chapter we shall take up the study of variations of national income, we shall see how and in what ways it can change from year to year. Such a study becomes necessary for the reason that no economy can remain stationary for any length of time and consequently national income cannot remain constant over time Not only that, the variation of national income cannot exhibit the same pattern at all times or in all the countries

There are various ways in which the income of an economy can change. In the first place, it can increase or decrease continuously; in the second, it can increase and decrease by turn. In the former case, national income is said to be growing (decline being regarded as negative growth), in the latter, fluctuating. This is a broad, twofold classification of change. Each of these two categories of change may exhibit many varieties Continuous growth, for instance, may be exponential, i.e. tending to infinity, or asymptotic, i e. tending to reach an absolute maximum Further, when income increases exponentially, the rate of increase may be increasing, constant or decreasing. Similarly, when income fluctuates, the fluctuations may be explosive, damped or constant. These changes are illustrated by the diagrams page 28. In what circumstances national income would vary in any one or more of the ways indicated in diagrams we shall see later on when we take up the study of some cyclical and growth models.

CAUSES OF CHANGE OF NATIONAL INCOME

Every economic phenomenon, as in fact every phenomenon anywhere else, must have a cause. If income varies from time to time, there must be some forces responsible for it. These forces may

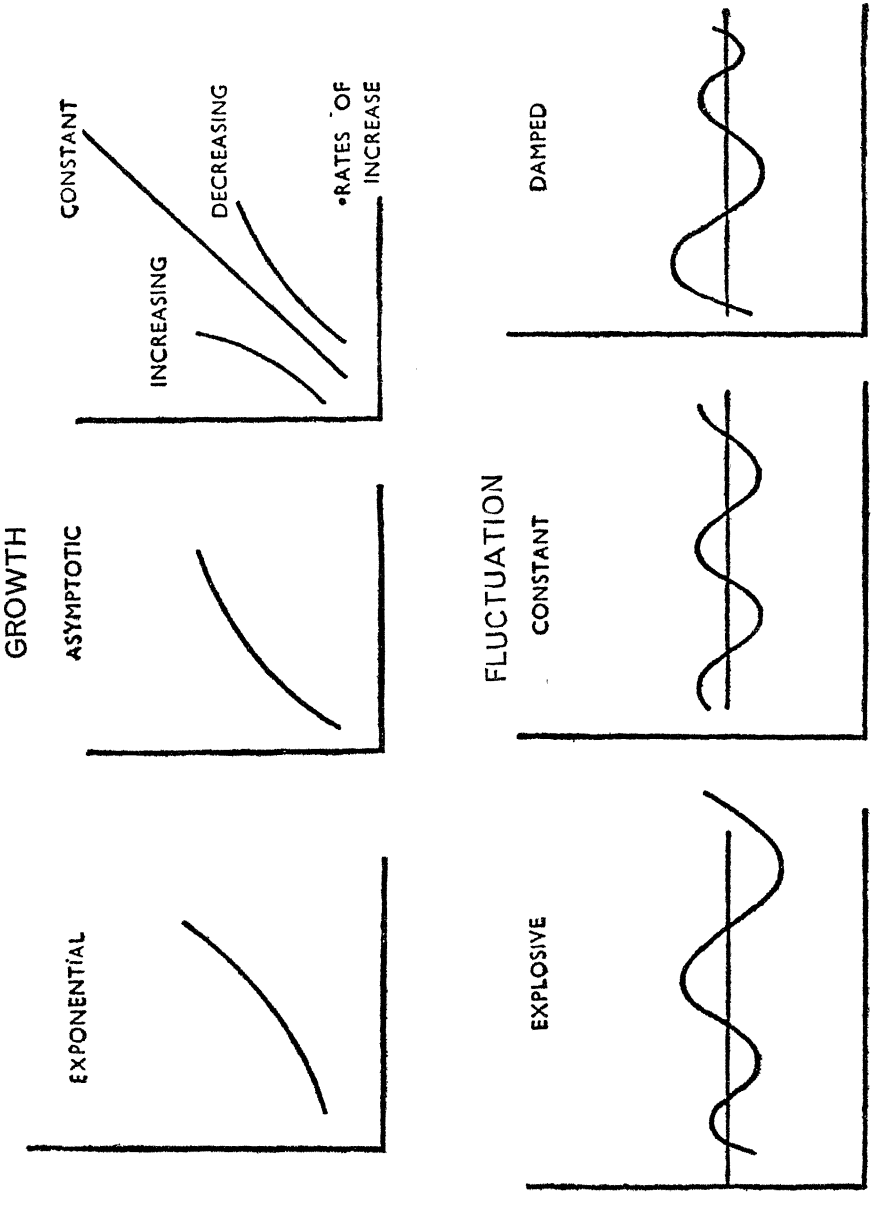

GROWTH
EXPONENTIAL
ASYMPTOTIC
CONSTANT
INCREASING
DECREASING
RATES OF INCREASE
FLUCTUATION
EXPLOSIVE
CONSTANT
DAMPED

FIG. 1

work from within the economic system or may be imposed on it from without. The former set of forces are called endogenous, the latter exogenous. If changes keep on occurring due to endogenous forces, the system becomes perpetually unbalanced. It is, however, difficult to make a clear distinction between endogenous and exogenous forces because of the difficulty of drawing a boundary line round an economic system. One does not know where exactly one system ends and another begins. That is why sometimes the growth of population and inventions are regarded as exogenous forces. In a way they are and in a way they are not One can look upon population, for instance, as growing from within itself, without having to depend for such a growth on any external agency. But when we place a narrow interpretation on the word *system*, all changes in population and technique of production must of necessity appear as needing exogenous factors to sustain themselves. It is perhaps not possible to widen the concept of a system so as to make perpetual motion a reality. We do not live in a vacuum ; we are influenced by forces that operate some times unsuspectedly from outside our economy, unless we extend its bounds so as to engulf the whole universe in it.

Let it be noted at the outset that national income is the result of the work that factors of production do. That brings to the forefront the causative importance of quantity and quality of factors of production.

Suppose that an economy has a given stock of factors of production of specified qualities. In other words, let us start with given quantities and qualities of factors of production. If the economy now makes a greater or less use of these factors its national income would accordingly change. With greater use output will increase, while with less use it will decrease. No change in income can occur unless there is a change in the use of factors of production. And unless such a change in factors of production is sustained, income must ultimately stop changing. The position of equilibrium of income can be attained before all resources are fully employed. Whether they are fully employed or not would depend on the willingness and ability of the system adequately to increase the use of factors of production

But income can change also due to qualitative changes in the use of factors. An economy instead of making a *greater* or *smaller* use of factors of production might make a *better* or *worse* use. Such

altered use would cause national income to change. Again, if such a change in the use of factors is not continuous, national income would ultimately stop changing And here also equilibrium might be reached before the *best* use is made of all available factors.

At the outset we encounter two difficulties which have great importance in theory. What does *full* use of a factor mean? What does *best* use of a factor mean? We are reminded of the difficulty of defining full-employment which has suggested the use of the term *over-full-employment.* Since there can be nothing like greater than full-employment, the concept of over-full-employment must be discarded We shall not involve ourselves here in the difficulty of defining full-employment or best-employment. Suffice it to note that it is theoretically of great advantage to replace the term *full-employment* by the term *optimum-employment,* in which case full use and best use would tend to merge into one.

Note for instance the fact that greater or less use of a factor might, and perhaps must, cause a change in its quality. An overworked man or a machine is qualitatively a different unit from an underworked one. Similarly, better or worse use of a factor may, and perhaps must, cause its quantity in actual use to change. These considerations give rise to the question of measurement of quantity and quality. To be practical, we can measure the quantity of a factor in terms of its physical units. For instance, to measure labour we can count the number of labourers. Likewise, quality can be measured in terms of potential or inherent capacity of a factor to produce goods. This measure is less practical than that of quantity and is bound to be so by virtue of the fact that quality is an abstract thing.

When we measure quantity and quality in this way, *greater or less use of a factor* would mean the same thing as use of *greater or smaller amount of a factor.* Similarly, *better or worse use of factors* would mean the same thing as the use of *factors of better or worse kind* (quality).

MORE FACTORS OR BETTER FACTORS AS THE CAUSE OF CHANGE OF INCOME

We saw above that income changes only if factors of production change. And factors of production can be changed in two ways; we can employ either a larger quantity of the factors (already in

use) or better quality of factors (presumably in the same quantity as before). We have parenthetically said *presumably* because when quality is changed our rule of measuring quantity cannot strictly be applied so that there is no way of knowing whether the quantity is the same. Anyway, there are these two ways of changing the output of goods and services that constitute national income.

Of these two ways of increasing national income let us take up first the quantitative increase of factors. There is a limit to the increase of income that is set by the level of full-employment. If this level has not been reached, if there are some unemployed resources, national income can be increased by employing idle factors, that is, by increasing the quantity of factors in employment. But is there any such maximum limit to the increase of income that can be secured by employing better quality of factors? First of all there is a question that poses itself here. Wherefrom can one get better quality of factors? Wherefrom can one get factors whose maximum capacity for work is greater? Perhaps for a supply of such superior quality of factors, we have to depend on exogenous sources.

The above consideration underlines the necessity of a better understanding of the nature and character of exogenous factors. We observed earlier that increase of population and improvement of technique are regarded, in some contexts, as exogenous changes If population increases, is it the effect of some change that occurs within the economic system? If the technique of production improves, is it the effect of some causal forces that operate from within the system? In other words, are changes in the size or composition of population or in technology *induced* changes or *autonomous* changes? A careful thought given to these questions would perhaps reveal the truly endogenous nature of all such changes.

If, however, the quality of factors improves, the improvement can be considered as the output of some productive enterprise; we *produce* an improvement in the quality of factors. It should follow, therefore, that production or national income can increase only if there is under-employment of factors of production and/or under-development of their quality or potentialities.

Before we pass on to the next question let us repeat that national income can increase only when larger quantities or better qualities of factors of production are employed. And for that there must

be under-employment or under-development of factors. We shall consider the full implications of these features of an economy in subsequent chapters.

THE CAUSES OF CAUSES

Increased employment of factors of production or the employment of better factors, or a combination of both of these, constitutes the cause of changes in national income. But, as we saw earlier, national income can change in various ways; it can increase in at least three ways (and similarly decrease) and it can fluctuate also in at least three ways. If, then, there are at least six types of change, there must be six types of change on the side of factors of production The question should then arise as to why factors change in so many different ways. There must be some cause or causes of such diverse changes on the side of productive factors. In other words, there must be causes of the causes of variations of national income. These ultimate causes of variations of national income are partly natural and partly not. Those that fall under the latter category are technical, behaviouristic and institutional in character. Among the technical causes may be mentioned the capital-output ratio. Among the behaviouristic causes can be mentioned the habits of consumers and producers. Here we have the coefficients of consumption and investment. And among institutional causes we may note the banking system as exercising at times a strong influence on the determinants of national income.

All these causes—technical, behaviouristic and institutional—come up for consideration in the study of growth models which we shall make in a separate chapter.

STABILITY VERSUS GROWTH

It is not difficult to imagine the national income of a community fluctuating from time to time, i.e. increasing for some time and then decreasing. It is also easy to imagine, without violence to theory, a case of stable income. In practice, income may change and keep on changing; but there is nothing in theory to prevent us from assuming, if we choose, that it is constant over time. When we come, however, to a continuously increasing income we find it difficult to search out a theoretical justification for it. For

a continuously increasing income (and that comes within the concept of growth), there must be an ever increasing use of factors of production or an ever increasing improvement in their quality.

For quantity as also for quality we are, in the final analysis, dependent on Nature We cannot create matter nor effect a continuously progressing improvement in its inherent properties. We have a given stock of natural resources and it is difficult to imagine our making a continuously increasing use of it. In fact, one can merely change the shape and form of matter but cannot increase it. If production has to increase continuously we must hopefully look to the other side of the problem, namely a continuous improvement in the quality of materials supplied to us by Nature. That, in the terminology of the art of production, becomes a case of *technological advancement. The problem then before us is, can technology go on improving for ever?* Perhaps it can. And the direction in which we are marching today holds out promise of a bright future. With the growing use of atomic energy our productive powers are increasing and we feel hopeful that with the same quantity of natural resources and manpower we shall be able to increase, and perhaps continue to increase, the production of wealth. That may not be a desirable thing For, such an increase is bound to impose an unbearable strain on our nerves But the fact remains that modern developments in the use of nuclear power give us an assurance that national income can be made to increase tremendously in the foreseeable future.

There is, then, nothing in theory or in logic to prevent us from imagining a case of continuously increasing national income, i.e. a true case of unrestricted growth. Development in the technique of production is the same thing as improvement in organisation. It is this factor (organisation) that is capable of increasing and improving without any conceivable limit. The growth of organisation, it appears, can never encounter a ceiling. Matter external to man cannot increase and perhaps man himself cannot multiply without limit; but he can improve his quality and, by putting that to proper use, improve also the quality of material resources placed at his disposal by Nature. That way we progress and that way we increase our income.

CHAPTER 4

STABILITY OF INCOME

MEANING OF STABLE INCOME

NATIONAL INCOME consists of goods and services but is measured in terms of their money-value How precisely it is measured was explained in Chapter 2. In Chapter 3 we explained the meaning and examined the causes of variable income. We shall now define stable income before we pass on to a study of the conditions necessary for stability of income.

Income is said to be stable when its money-value does not change from year to year The natural period of production of wealth is not one year; it is a mere convention to select this period for purposes of reckoning. The longer the accounting or computing period the greater the chances, other things being equal, of national income remaining stable.

The above is not the only meaning of stability but it is one on which we shall concentrate here. As we have observed earlier, the income of a community does not remain stable for any length of time Yet it is useful for our purpose to study the conditions in which it *can* remain stable If we know the causes of stable, unchanging income, we can better appreciate the nature of the causes of fluctuating or growing income

HOW INCOME IS PRODUCED

Natural and human resources of a community constitute the source of a country's income. Real income (i.e. goods and services) is produced by the cooperative efforts of these resources. To use the language that is reminiscent of Marshall, labourers, organisers and entrepreneurs acting on natural resources produce wealth which constitutes the income of a nation.

In a capitalistic economy, factors of production are hired by a producer. These factors under the direction of the hiring producer turn out a certain quantity of output. This is sold in the market for money. Out of this money-income (or in anticipation of it),

the hired factors are paid their remuneration. The income that a producer gets, thus, goes back to the factors that produce it. The hiring producer may be and generally is a factor of production himself. He has, therefore, to pay himself also for the services he performs. Anyway, money keeps on circulating. The producer pays the hired factors and the hired factors pay, as it were, the producers When the money comes back to the producer the round is complete But the circle continues There is, therefore, a circular flow of money that constitutes the income of the factors of production (consumers) and the hiring factors (producers).

The above is a simplified picture of the working of an economy. It is a simplified picture because in real life there is a chain of producers in a vertical scale and the money paid by producers to factors of production does not come back to them at the same time. All incomes are not earned at the same time by factors of production and the producers do not get the money back in one lump.

However, what we must note at this stage is that there are two sides to the picture of an income-producing economy. There is the producers' or the supply side, and there is their consumers' or the demand side Producers' behaviour is governed partly by technology and partly by their habits, which in turn are to an extent determined and influenced by their expectation of the future Consumers' behaviour has no technology to determine or influence it. Their behaviour depends on their incomes, their system of wants and their habits of saving and spending of money.

Production is *immediately* determined by the willingness of the producers to employ factors of production and the willingness of factors of production to accept the employment offered by producers. Behind the willingness of producers to employ factors there are the technology of production and habits and custom in regard to production. But besides being willing, the producers must also be *able* to employ hired factors. This ability depends to some extent on the supply of credit. The banking system, thus, to some extent determines producers' ability to offer employment to factors of production. Behind the willingness of people to accept employment there are the factors noted above, namely, income, system of wants and spending or saving habits.

CONDITIONS OF EQUILIBRIUM

In one sense of the word "equilibrium," there is equilibrium at all times and in all circumstances But there is a narrower sense in which an economy is in equilibrium only when certain conditions are fulfilled. We shall talk in terms of aggregates or, in other words, we shall make a macro-economic study of an economy That is easy to do as we can then argue as if there was only one producer and one consumer. There is some disadvantage in thus simplifying the study of the problem in hand but there is a great advantage also. We shall not stop to consider these advantages and disadvantages but shall simply remind ourselves that as we are concerned with national income, the most important tendencies in operation can best be studied when we view the economy as a single integrated unit.

The production of income can be imagined to begin with the decisions made by producers. We have to imagine that because once an economy has begun functioning, it is difficult to say which is the beginning and which the end of economic activities. Logically, the objective side of production of income has its beginning in the decisions of producers. And their decision to produce exhibits itself in their employment of factors of production and the purchase of material needed. And when factors are employed or services hired they have to be remunerated. Hence, a decision to employ resources is tantamount to a decision to spend money which is the same thing as the decision to invest money. For, spending money for purposes of production is called investment in economics. Hence, we can say that production (the objective side of it) begins with producers' decision to invest money

We must, therefore, know on what the decision of producers to invest money depends and what is the precise nature of that dependence. There are a large number of factors on which this decision depends. And perhaps different producers are influenced in different ways by these factors. And their decisions are perhaps never very constant, and even if they were constant, we do not quite know how they react to the conditions of the market. We have, therefore, to make some assumptions about the behaviour of producers. We must remember that an assumption is only an assumption and, therefore, our deductions would be only as much correct as our assumptions. Knowing this, all that we can do is

to make our assumptions as realistic as possible They can never be true to life but we should try to make them as true to life as our knowledge of human nature would permit.

Different economists have made different assumptions in regard to the behaviour of producers. The choice of assumption made is at times determined by the desire to make the problem in hand as simple as possible The solution of the problem of income determination has per force to become mathematical. We can illustrate the behaviour of producers and consumers by diagrams but when the problem is complicated, that is, when the relationships between various variables of the system are complicated, we have to use algebra and calculus Hence to make it easy for us to solve our problems we have to make assumptions that do not complicate matters, but at the same time the assumptions have to be, to a reasonable extent, true to life.

The most important factor on which the decision of producers to invest money depends is demand for their products In some way, therefore, total investment will depend on demand. Once an investment is made in capital-goods it has simply to be kept going. If a machine, for example, is bought and put to productive use, all that is needed is to maintain it. It undergoes wear and tear, and so some money has to be spent on its repair This is the problem of depreciation fund into the details of which it is not necessary to go. If the demand now increases, fresh investment has to be made Hence, every new investment depends on the increase of demand rather than on total demand.

In this chapter we are concerned with stable, unchanging national income. If the income is not increasing there will be no fresh investment needed, whatever was invested in the past has only to be kept going. Taking investment in capital-goods, if Rs. 10 crores are invested in production and if depreciation per year is Rs. 50 lakhs then a constant investment of Rs 50 lakhs would have to be made every year. If depreciation is not constant annual investment will also not be constant But investment, whatever it may be, will be independent of income though it would not be independent of everything else. When, therefore, income is constant or stable, investment is not a function of income in which case it is called autonomous investment. For purposes of solving the problem it is best to make autonomous investment constant

Now when income is constant, and since income-production is

initiated by producers it must be so because producers are in equilibrium. And they are in equilibrium when there is no inducement on their part to expand or contract production. Such an inducement will not be there when there is no surplus of income over aggregate cost or no surplus of aggregate cost over income. The producers are then in equilibrium, investment is in equilibrium and income is also in equilibrium.

We have finished with the supply side or the behaviour of producers. We now pass on to consumers or the spenders of income. The cousumers' job is to spend their income ; we must know then how they regulate their expenditure. Consumers, our commonsense tells us, spend more when they have a larger income. But we also know that they spend a certain amount even when they have no income. A man must live and he must consume something to live. And to consume something he must spend something (or what comes to the same thing, somebody must spend on his behalf). Most consumers do not spend the whole of their income after it has reached a certain amount. They spend a part of their such income and save the remaining amount. If they spend 75 per cent of their income when it is, say, Rs. 500, they would spend less than 75 per cent when it rises above Rs. 500. To simplify the solution of the problem we can assume that consumers spend a constant percentage of their income.

We can put down the above facts expressing them algebraically as follows.

Since we are considering a situation in which income is constant, investment does not change; there is no induced investment (this point is clarified later) and autonomous investment is considered to be a constant amount, giving us

$$I = \bar{I} \qquad (1)$$

We can express consumption of the people by the following equation:

$$C = cY + a \qquad (2)$$

c is the ratio of consumption to income and a is autonomous consumption.

Since equilibrium of the system means the equilibrium of the mental state of producers and since they are in equilibrium when what they pay to the factors of production equals what they get from them (recall what we said about national income. We said that in

equilibrium the two measures of national income are equal), we get the following equation as expressing the condition of equilibrium:

$$Y = cY + a + \bar{I} \tag{3}$$

The left-hand side is Y which is the total income received by factors of production (national income from producers' point of view) and the right-hand side shows the amount the factors (consumers) spend plus the amount that is invested. If we take a jump and identify investment with saving, the right-hand side equals the amount people spend and the amount the people save. Since we are taking a macro point of view, the amount saved and then invested can be taken to be the amount that is returned by the factors of production to the producers.

From equation (3) we calculate the value of income to be

$$Y = \frac{a + \bar{I}}{1 - c} \tag{4}$$

This value of income (Y) is, let us recall, the equilibrium value, that is, when national income is stable it is equal to the above right-hand expression in the equation

Since c is the proportion of the income that is consumed, $1-c$ becomes the proportion of the income that is saved. Hence we can write s for $1-c$ where s is the proportion of income saved. National income, then, becomes equal to $\frac{a + \bar{I}}{s}$ a is autonomous consumption, let us remember, $\bar{I}$ is autonomous investment and s is the savings ratio.

If the consumption ratio c is 80 per cent, then s becomes equal to 20 per cent or 1/5 Income Y then becomes equal to $(\bar{I}+a) \times 5$. If we make a equal to 0, assuming that there is no autonomous element in consumption (when income is large, a becomes small and can be neglected), then national income Y becomes 5 times the autonomous investment.

DIAGRAMMATICAL REPRESENTATION OF STABLE INCOME

Diagrams help us to understand economic phenomena for two reasons. First, when we have a diagram our eyes help our mind to understand them. Second, we can see a diagram in its entirety. In verbal explanation of principles we understand the phenomena bit by bit. We, therefore, draw below a diagram to illustrate the determination of stable national income.

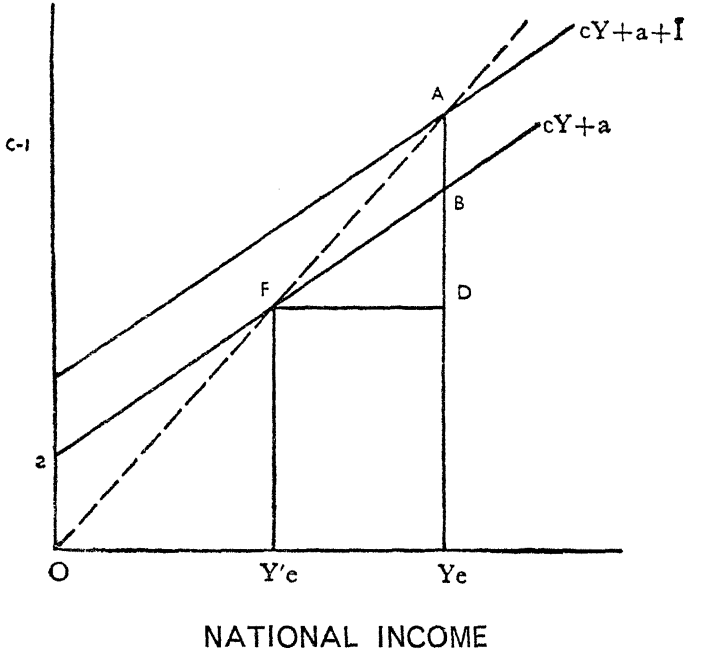


FIG 2

On the horizontal axis we measure income (Y), and on the vertical axis consumption (C) and investment (I). The line $cY+a$ shows the amount of money spent on consumption. The vertical coordinate shows consumption and the horizontal coordinate shows income. Oa, it will be obvious, is equal to a, and c is the slope of the line. The line $cY+a+\bar{I}$ shows the amount of money spent on consumption and the amount invested. The vertical distance between the two lines equals the fixed autonomous investment $\bar{I}$. The dotted line through the origin makes an angle of 45° with the axes. Its vertical and horizontal coordinates are, therefore, equal. The point A is the equilibrium point giving OYe as the stable national income. For, when income is OYe, the amount spent on consumption and that invested equal AYe which by the property of the dotted line is equal to OYe. Hence, the total income earned by the factors of production is spent.

In an economy where there is autonomous consumption and also induced consumption that varies in a fixed way with total income and where investment is autonomous and fixed, income is determined as shown above. The income is stable, unchanging from one period of time to another. What the implications of a stable level of national income are we shall see later on We note here that national income, from the point of view of producers, is equal to national income from the point of view of consumers. The producers are in equilibrium because they recover and just recover their costs and consequently production is stable giving rise to an unchanging national income

THE MULTIPLIER IN THE CASE OF STABLE NATIONAL INCOME

It will be seen from the diagram that when there is investment of amount AB, income increases by the amount $Y'eYe$ For, when there is no investment the equilibrium income is $OY'e$ From the property of the dotted line this increase of income is equal to AD In this diagram AD is three times AB, which means that income increases by as much as three times the investment In economics, 3 is called the multiplier

Now look at the equation (4). The income is $a+\bar{I}/(1-c)$ This is equivalent to the income OYe in the diagram. It can be easily seen that $a/(1-c)$ would be equivalent to $OY'e$ in the diagram Thus, the increase of income AD in the diagram is equal to $\bar{I}/(1-c)$ in terms of our equation. The multiplier is thus $1/(1-c)$. Since in the diagram the multiplier is 3 it is evident $1-c$ is equal to $1/3$.

Since AB is one-third of AD, BD is two-thirds of AD (which is equal to FD). Hence the slope of the consumption line is $2/3$. In the language of the equation, then, c is equal to $2/3$. $1-c$ therefore equals $1/3$ And since the increase of income due to investment is $\bar{I}/1-c$ it is equal to $\frac{I}{1/3}$ or $3\bar{I}$ Hence the multiplier is 3.

We can then say that an investment of a certain amount of money increases income (when stable conditions are considered) by 3 times that amount. In general, income increases by an amount that is the multiplier times the investment $\left(\frac{\bar{I}}{1-c}\right)$.

WHY IS THE MULTIPLIER WHAT IT IS ?

When an economy invests an amount, say one hundred, income (when it has stabilised itself) becomes three hundred when the propensity to consume is 2/3 That means that when the propensity to save is 1/3, income increases by an amount three times the investment. And when income has increased to that extent it does not change. Nothing then happens to cause income to change. We can then say that given the state of an economy, an addition of capital equal to 100 to the productive system causes an addition of 300 to income. The capital-output ratio is then 1/3. The multiplier is then the inverse of capital-output ratio But it should not be concluded from this that the multiplier is entirely a technological coefficient Whether output increases to the extent of three hundred or more is in a way a technological fact. The productive system must possess the necessary technological potentialities for income to increase to that extent. But we see that if the propensity to consume is 75 per cent the propensity to save is 25 per cent and the multiplier becomes 4, income increases by 400 per cent. Does it imply that technology has improved ?

We have just said that when an additional investment of 100 is made, income increases by 300 or 400. This language is misleading. In the case we are studying there is no *additional* investment; there is the constant investment in capital-goods equal to $\bar{I}$. The *AB* line in the diagram is the line of consumption and not of investment. It shows that if income was *OYe*, *BYe* would be consumed. But income cannot be produced without investment. We understand here by investment, expenditure of money on capital-goods. Hence, the investment of *AB* of money is necessary for the production of income *OYe*. Capital-goods are so fitted into the system and their amount so regulated as to produce income *OYe* with the consumption function given by the line *aB*. The technology of production is not invariant with income and income is not invariant with the consumption function—the propensity to consume. It is in this way that the multiplier is not the product of technology and the propensity to consume. Technology and propensity to consume jointly determine income and then the multiplier *appears* as capital output ratio. Moreover, as we are taking a macro-economic case the concept of capital-output ratio has not the same meaning that we usually

attach to the word More than that need not be said here.

SAVING AND INVESTMENT IN CASE OF STABLE INCOME

In the case considered above we have made no specific mention of saving Out of an income of Y the economy spends or consumes cY. Naturally therefore $(1-c)Y$ remains saved And in the case of stable income this must equal the investment $\bar{I}$. In the diagram, AB is the investment, for that is the vertical distance between the lines passing through A and B And since the income is OYe which is equal to AYe out of which BYe is spent or consumed the amount AB is saved Saving and investment are equal when income is stable.

Coming to algebra, $Y-(cY+a)=\bar{I}$. This we get from the equation (3) by transferring $cY+a$ from the right side of the equation to the left. Since Y is the income and since the expression within brackets is consumption, $Y-(cY+a)$ equals saving. Hence the left-hand side is saving and the right-hand side is investment ($\bar{I}$). In the case of stable income, therefore, saving is equal to investment.

There are two conditions of stability of income that we have explained above. From mathematical point of view they are one and the same, but when stated in words they have, to an extent, different significance. The first condition is that the income of the producers must be the same as the income of the factors of production. And that is so when consumption plus investment equals income. The second condition is that savings must be equal to investment. And that is so when the money that is not spent on consumption-goods is invested, i e spent on capital-goods. In both the cases what is required, therefore, is that the flow of money must be maintained. No part of money should be idle and unused. Money should act as money ; it should be used either to buy consumption-goods or capital-goods. If a part of it is not put to either of these uses it ceases to serve as money. It then becomes a consumption-good. In other words, when money is hoarded it is converted from money into consumption-goods. For stability of income we, therefore, require a continuous flow of money; money should not be hoarded.

AUTONOMOUS PLUS INDUCED INVESTMENT

While dealing with the case of autonomous investment we had an

occasion to observe that when income is stable there is constancy of investment; and when investment is constant it can be considered as invariant with income. This is, in a sense, a correct view But it should not be concluded that the amount of autonomous investment (autonomous in the above sense) has been determined independently of income. The investment is what it is because the income is what it is And income is what it is because of the consumption function. And the investment that appears in the garb of autonomous investment is what is required to produce that income. The income has not been the result of a predetermined amount of autonomous investment. Income and investment are simultaneously determined.

In the background of this knowledge, let us now introduce in our model induced investment—investment that varies with the level of income As we shall see, this change in the investment function makes no fundamental difference to the mathematical solution of the problem of income determination. Let then total investment be equal to a fraction i of income plus an autonomous amount $\bar{I}$. Investment then becomes equal to

$$I = iY + \bar{I}$$

Keeping the consumption function the same as before,

$$C = cY + a$$

we get national income to be equal to

$$Y = cY + a + iY + \bar{I}$$

from which we get an expression for it

$$Y = \frac{a + \bar{I}}{1 - c - i}$$

National income in this case differs from that in the previous case by the inclusion of $(-i)$ in the denominator.

From the above value of national income we can calculate the difference that is made by the autonomous investment $(\bar{I})$. In the absence of this investment, national income would have been less by the amount

$$\frac{\bar{I}}{1-c-i}$$

We can replace c by $1-s$ where s is the savings ratio. The loss

of income, then, can be expressed by

$$\frac{\bar{I}}{s - i}$$

The multiplier now is found to be equal to the above value The following facts are important and must be carefully noted here. The induced investment (i) is a fraction of the total income which is taken to be constant. s is a fraction of income. Suppose that s is 1/5 and let us further suppose that i is 1/10, then the multiplier becomes $1/(1/5 - 1/10)$ which is equal to 10.

All calculations of the multiplier in such cases of stable income are very misleading Take the case of the coefficient i We have said that it is a fraction which means that the investment in capital-goods is a small portion of total income This means, since income is not increasing, that it is the amount of investment that is needed to keep the capital structure intact In short, iY is depreciation To regard it as induced by income is mathematically correct but otherwise misleading. When income is increasing, the increase of income *induces* producers to make a fresh investment in their plants The investment iY is not induced investment in that sense It is rather the investment that is induced *now* by technological wear and tear. Again, to say that due to the two types of investment—autonomous and induced—income increases is misleading Income is not *increased* but *generated* by the investment. This investment has come to stay as necessary expenditure that keeps capital structure intact. The distinction between autonomous and induced investment loses all significance We repeat, when income is stable there is very little sense in speaking of induced investment

The above point is important inasmuch as most authors have failed to make the distinction between induced investment in the case of growing income and induced investment in the case of stabilised economy clear. And what follows from our discussion is that the word *multiplier* when used in the context of a stable economy is misleading.

CHAPTER 5

FACTORS OF PRODUCTION AND STABLE NATIONAL INCOME

FACTORS OF PRODUCTION

THERE ARE two categories of factors: one is human and the other non-human. The human factors are labour, organisation, enterprise and capital In fact, when they are characterised as human factors they are called labourers, organisers, entrepreneurs and capitalists. Their functions are, respectively, to supply physical force, mental exertion, uncertainty-bearing and waiting. That is so in theory; in practice, the so-called labourer does some mental work also The organiser does some physical work and the entrepreneur might do both physical and mental work besides bearing uncertainty while the capitalist might bear uncertainty besides doing his specialised work of waiting. In other words, it is not possible to find a labourer in isolation, nor an organiser, a capitalist and an entrepreneur; each man combines all the factors in himself though in varying proportions.

The non-human factor is called land. When land is worked upon, it becomes capital And it is difficult to find land that has not been worked upon All the material things which the above human factors handle may, therefore, be called capital-goods. Men and matter combine or coorperate to produce wealth or income.

When these factors are engaged in producing wealth (which may be alternatively called income) they are said to be employed When they are not so engaged, they are said to be unemployed. Logically speaking, no factor of production can remain unemployed. For, when a thing is unemployed it is not a factor of production. Similarly, when a man is unemployed he is not an agent of production. It may be more correct, therefore, to use the word *resources* and say that they are unemployed when they are not engaged in the production of wealth. However, we shall follow the usual practice of speaking in terms of factors of production.

EMPLOYMENT OF FACTORS

Other things being the same, national income is maximum when all the available factors of production are employed But factors cannot be combined in any and every proportion If, to talk in terms of only two factors, 10 labourers can best be combined with one machine, production would suffer if 9 or 11 labourers were supplied one machine to work with Yet something can always be produced even when we employ less or more than 10 labourers But in some cases it is not possible to vary the proportion at will The proportion in which the various factors are combined depends on technology and the relative cost of employing the factors When we *can* employ factors in any proportion we like, the (technical) coefficients of production are said to be perfectly variable When there is only one proportion in which factors can be combined, the (technical) coefficients of production are said to be fixed

When the coefficients of production are perfectly variable and there are no rigidities and frictions no factor can remain unemployed When the coefficients of production are not so elastic (and that is the case in the real world), some factor or factors must remain unemployed even in the absence of all rigidities and frictions. But in our modern economies we witness a different phenomenon for most of the time *all* the factors are found underemployed When the percentage of unemployment is small, economists are not bothered For, the unemployed can easily live on the income of those who are employed. But when unemployment assumes larger proportions it becomes difficult for them to live on the income of other people The economist is concerned with such cases of unemployment

The classical economists (with rare exceptions) maintained that unemployment cannot rise above a certain level They believed in Say's Law of the Market, according to which whenever factors of production are employed they not only produce wealth but they produce also the income needed to buy that wealth There can, therefore, be no over-production and the employers would have no hesitation in employing all the available factors of production

FULL-EMPLOYMENT AND UNDER-EMPLOYMENT

Can there be unemployment of some factors of production in an

economy that has stable income? As we just said most of the classical economists thought that unless some obstructions are deliberately placed in the way of the operation of market forces, there cannot be equilibrium (stability of income with equilibrium in the case we are considering here) till all the resources are fully employed It is necessary for us to say a few words, therefore, about full-employment and under-employment

It is said that when all those who are able and willing to accept employment at prevailing wage rates are offered employment, the state of full-employment is reached. When some of the willing persons do not get employment at the prevailing wage rates employment is less than full The same can be said about capital resources Unemployment thus refers to involuntary unemployment.

The above is a practical view of full-employment. From theoretical viewpoint it has many loopholes. Can we say that a child is unemployed when it is willing (but not able) to work at the prevailing wage rate in an occupation in which we would not like it to be employed? Has full-employment anything to do with hours of work? If a man is employed for only an hour a day, is he fully employed if he is willing to work for longer hours? If a man is willing to work for only half an hour a day and gets a job to his liking, is he fully employed when he works for an hour? But the above definition of full-employment overcomes these difficulties by having nothing to do with such questions. If you are willing to accept work at the prevailing wage rate and succeed in getting it, you are fully employed.

Thus, full-employment is a state in which there is full satisfaction as it were on the part of factors of production. The same can be said of machines. Here it is the machine owner who must be fully satisfied with the use he makes of the machine. The only test of full-employment is that the demand for employment must be fully satisfied at the prevailing prices (of services). From the point of view of the problem in hand, the definition is not unsatisfactory.

The question can, then, be posed as follows: when income has been stabilised will there necessarily be full-employment of resources? The classical economists said "yes"; modern economists say "no". We know that there were some among the classical economists such as Malthus who did not believe in Say's Law of Market. But the classical economists as a class believed in full-

employment. Keynes was the first to emphasise the fact that due to certain rigidities in the economic system equilibrium might be attained too soon, i.e before all the resources were fully employed.

We know that equilibrium demands that those who pay the factors of production employed must get back the money. As we said earlier, it means that the income of factors must be equal and just equal to the income of factor-employers or producers. When the circular flow of money is thus established, there is equilibrium. If some people are unemployed they can be absorbed in the productive system provided the income they earn when employed comes back to the system that employs them. There might be some difficulty here due to our speaking in terms of aggregates. For, one employer might get back less than what he had paid to the employees while another might get more, keeping the aggregate sum equal Such a situation would not be consistent with a true equilibrium state But, on the whole, equilibrium requires it as a pre-requisite that the income of factors and income of employers of factors are equal

Since money is not wanted for its own sake (if everything we call money is really money), it is natural for us to expect that the factors of production would spend the whole of their income. And similarly, the employers would also spend the whole of their income in producing wealth And if what we thus expect comes to happen, there would be full-employment of resources And when there is under-employment, we can be sure that either the employees or the employers are not spending their entire earnings. And when they do not spend all that they earn, some money remains unused. The unused money ceases to be money in the strict sense of the word because it now becomes a thing that is desired for its own sake.

When some part of income is thus not spent, changes occur in the economy. Production is curtailed and if when that is done people begin to spend a larger part of their earnings, employment again increases. But people who were spending a certain part of their income cannot be expected to spend a larger part of it when production is cut down. Expenditure can increase only when money is transferred from those who have a low propensity to spend to those who have a high propensity. That requires transference of money-earnings from the rich to the poor or the poor to the poorer and, in general, from the employer-class to the employee-class.

Such a shift of purchasing power requires either a change in the relative earnings of the people or a pumping in of fresh purchasing power concentrated in the hands of people who have a high propensity to spend. The first thing is difficult to happen in the normal course of economic activities. For, when there is unemployment of workers it is difficult for their earning-rates to rise. And unless that happens the desired shift of purchasing power cannot be effected. We have, therefore, to depend on the second change. Pumping in of purchasing power that would tilt the balance in favour of those whose propensity to spend is greater can be done only by the government.

FULL-EMPLOYMENT AND UNDER-EMPLOYMENT OF MONEY

Since production includes not only manufacture of goods but their exchange also, we need factors to manufacture goods and factors to exchange them. These latter category of factors is called money. Hence, we should widen the concept of unemployment so as to be able to include money in it.

We saw earlier that when the technical coefficients of production are not sufficiently elastic it is not possible to secure full-employment of all the factors. Even when circumstances are favourable for full-employment of factors, a factor that is in abundant supply (due to inelastic coefficients of production) has to remain partially unemployed. Now, when we have money as one of the factors of production, we should bear the fact in mind that it is possible to extend the concept of elasticity of co-efficients of production so as to make it applicable to the case of money as well. Coefficient of production now becomes a concept of wider denotation.

Factors of production other than money can remain either voluntarily unemployed or involuntarily unemployed. In the former case, psychologically there is no unemployment. Just as when people go off to sleep in the night they are not regarded as unemployed. Similarly, when people do not *want* to work they are not regarded as unemployed. For, such abstention from work does not constitute a psychological imbalance. Coming to the factor *money*, we can apply the same distinction of voluntary and involuntary unemployment.

Money is unemployed when it is not used as a factor of production. And it is not used as a factor of production when it is neither

spent on consumption-goods nor on capital-goods. It is unemployed, therefore, when it is *hoarded*, i.e. it is unemployed when it ceases to act as money. Hoarded money or unemployed money serves as a consumption-good. If a hoarder of money is called a miser, we can say that a miser consumes what others would use as a means of production.

In the above paragraph we have placed a strictly logical interpretation on the word *hoard*. When a man keeps some money with him for future use and does not utilise it either for procuring consumption-goods or for procuring capital-goods *in the present*, it does not become a hoard in the strict sense of the word. For such a store of money does not constitute consumption-good. Such a wise or cautious man who saves for the future cannot be said to be *consuming* money. His savings are his capital. And yet trouble starts when people maintain such a cash-balance with them. To understand the problem under consideration we have, therefore, to use the word *hoard* in a different sense. For us, then, money can be said to be unemployed when it is not used to buy consumption-goods or capital-goods *in the present*. The scope of the word *present* will in each case be determined by the period of time appropriate to the analysis of the situation in hand. Money is employed, speaking conversely, when it is used to buy (in the present) consumption-goods and production-goods. In the employments of money we, therefore, do not include the case of buying of securities or liquidity. For, our concept of production includes only the production of consumption-goods and capital-goods.

Now comes the question of voluntary and involuntary unemployment of money. Money, like capital-goods, has no mind and so it cannot *want* to be employed or unemployed. It is the owner of money who decides whether money shall be employed or not. If he voluntarily takes the decision not to employ money, we can say that money is voluntarily unemployed. If the owner of money is compelled not to employ it (i.e. not to use it for the purpose of buying consumption-goods or capital-goods in the present), it remains involuntarily unemployed. Such cases are comparatively rare The government can more or less force people not to spend money in the present in one way or another. For instance, goods can be rationed or a heavy consumption-tax can be levied. But such cases of involuntary unemployment of money are unimportant for our purpose.

Money, then, can become voluntarily unemployed and when it is unemployed the income of producers (employers) falls short of their cost, i.e. they do not get back the money they pay to factors of production As we explained earlier, in such a case unemployment results, the economy settles down to a position of equilibrium before the factors are fully employed. Voluntary unemployment of money causes involuntary unemployment of other factors of production

This effect is not peculiar to money; whenever a factor of production decides to remain unemployed, it forces some unemployment on the remaining factors And this unemployment is greater the less elastic are the technical coefficients of production If some labourers decide (of their free will) not to work, some machines have to remain unused as a machine can never be a perfect substitute for labour (there cannot be perfectly elastic coefficients of production).

Just as there are various ways in which one factor of production can be combined with another so also are there various ways in which money (which is also a factor of production) can be combined with other factors But here also the coefficients of production (not technical but, shall we say, business?) are not infinitely elastic. Were they so, the unemployment of money would not have caused unemployment of other factors of production. The economy would then have readjusted itself to the reduced supply of active money. We conclude, then, that the cause of under-employment stability of national income is (voluntary) unemployment of money. If money was not there in our economic system this cause of under-employment would have become inoperative. However, in a barter economy voluntary unemployment of any other factor of production can cause under-employment of resources.

Since income is produced by factors of production, when there is under-employment of resources, national income is below the possible maximum. This maximum income can be called capacity-income or natural-income. It is natural in the sense that if Nature was given a free hand and man's decisions were not voluntarily taken, income would have reached that level.

BARTER STABILITY AND UNDER-EMPLOYMENT

Factors of production are, as we have explained, under-employed

even when national income has stabilised itself because of the voluntary unemployment of money. Can we remove this cause of under-employment by organising an economy on barter system? In the case of barter, goods (services also) are exchanged for goods. It is arguable that in such a case goods function as money If I give wheat to get rice in return I am treating wheat as money For, wheat serves as a means of procuring rice. We need not go into these logical niceties Let us see what would happen when one consumption-good or production-good is exchanged for another. The case of barter differs from the case of money-economy in one relevant respect In the case of barter-economy, everything has intrinsic utility in the sense that it would be directly used either as a consumption-good or as a capital-good in times of need. If I need rice I can get it in exchange for wheat. Even when I do not need wheat (or not as much as rice in any case), I can still consume it if I cannot get rice in exchange for it.' The other respect in which barter-economy differs from money-economy is that in the latter case it is possible to store up purchasing power almost indefinitely. In the case of barter, on the other hand, it is not possible to store purchasing power for a long time. This has a tendency to speed up the use of things and thus increase their velocity of circulation.

In modern economies one of the factors of production, one of the things that constitutes purchasing power, can remain unemployed. It can remain unemployed because it does not lose its value, in normal times, by remaining unemployed; rather its value often increases during the period of its unemployment When in a barter-economy goods are exchanged for goods, income or purchasing power is earned in terms of goods. And this purchasing power loses its value more quickly when it remains unemployed Unemployment of things that can serve the purpose of money is, therefore, difficult For this reason one important cause of under-employment of factors of production is very much weakened. We can say, therefore, that under-employment on any substantial scale is not possible in a barter-economy.

FUNDAMENTAL CAUSE OF UNEMPLOYMENT OF MONEY

Money remains unemployed when income earners do not spend their entire income either on consumption-goods or capital-goods.

And when they do not spend their entire income some part of it remains unspent as a provision for the future (we are ignoring the activities of misers). Those who do not spend their entire income, i.e. those who save a part of their earnings, may either keep the savings with themselves or lend them to others for use. If they do lend, the borrowed money becomes for the time being the income of the borrowers. And once it becomes their income it can be spent either on consumption-goods or on capital-goods. If these borrowers also save a part of this borrowed money the same old problem arises, namely, of money remaining unused in the present. But those who borrow are most unlikely to save it. We need not, therefore, consider this possibility. But those who save money might, as we have just said, keep it with themselves. In that case money does remain unused or unemployed during the current period.

When is such a thing likely to happen? When a man saves some part of his income he loses interest if he does not lend it to others. And he would not like to lose interest unless there is something else to gain by not lending. And what a man can possibly gain by not lending is the availability of the sum saved for more profitable investment in the future (the future that lies outside the period of time under consideration). And such better investment opportunities are anticipated by savers when the rate of interest is fluctuating and, due to better business prospects or due to other causes, they expect the rate of interest to rise in the future.

There is another reason also for saved money to remain unlent with the savers; borrowers may not be forthcoming to borrow money. And they would be unwilling to borrow when business prospects are poor. If the rate of interest charged is very much lowered some borrowers might be available, but then it does not pay the lenders to lend money for the reasons already mentioned.

If money remains unemployed for these reasons it is possible to increase its employment by stabilising interest rates and also by stabilising business conditions. But there is another way available to reduce unemployment of money. We can increase the expenditure of money by income earners. And that we can do by shifting purchasing power from those whose propensity to consume is low to those whose propensity to consume is high. There are various ways of doing that. The government can take some money from the rich (those whose propensity to consume is low) and pass it

on to the poor (whose propensity to consume is high). This the government can do through the exercise of its fiscal powers How the government can do that and what is the process by which the desired change in the employment of money is brought about, will be shown in the next chapter.

CHAPTER 6

FULL-EMPLOYMENT AND STABLE NATIONAL INCOME

NATIONAL INCOME can stabilise itself even when factors of production are under-employed. What is required for full-employment is absence of rigidities and frictions. These are caused along with other things by (voluntary) unemployment of a factor, money included. Money is needed for exchange of goods and services. We can, therefore, treat money as a factor of production when the word *production* is understood in its widest sense. Voluntary unemployment of money is much more possible and much more common than voluntary unemployment of any other factor. When money is under-employed, some goods and services remain unsold; the income of the producers (employers) falls short of the income of factors of production. All the employment of factors that is possible in the circumstances is secured; income stabilises itself below the *natural, maximum* level.

To solve the problem something has to be done to bring about fuller employment of money. One way of doing that is to stabilise the rate of interest and economic conditions. For, when these are changing it becomes profitable to keep some money unemployed. The other way, which is easier, is to shift purchasing power to the poor who have a high propensity to consume from the rich who have a low propensity. This the government can do by the exercise of its fiscal powers. We shall see how fiscal measures can lead to greater employment of money.

FISCAL MEASURES

There are two ways in which the proportion of money spent to that saved can be increased. One way is to take away some money from the rich and give it to the poor. This can most easily be done by taxing the rich and spending the money in such a way that it becomes the income of the poor. The other way is to create additional money and utilise it in such a way that it becomes the income, mainly, of the poor. This second method

of reducing unemployment of money comes under the category of deficit financing, though there is another way also of accomplishing the same result Money can be borrowed from the rich and utilised in such a way that it becomes the income of the poor But when money is borrowed the loan has to be serviced, i e. interest has to be paid and the loan has to be redeemed eventually For that, taxes have to be levied So the loan method does not differ from the tax method; a loan is a delayed and prolonged tax. Hence, we have only two convenient ways of increasing the proportion of income that is spent one is to tax the rich for the ultimate benefit of the poor, the other is to provide fresh income to the poor by creating an additional supply of money

We shall take the latter case first Suppose there is underemployment of resources The government creates money (through the operation of the printing press) and spends it in producing or procuring some consumption-goods This can be called investment on the part of the government because it is not spending the money to buy consumption-goods for its own consumption The money is invested by the government in an act of production This money becomes the income of the people. If it becomes the income of those who have a low propensity to consume the situation becomes worse, and more money is found unemployed But, if a good part of it becomes the income of the poorer sections of the community the proportion of national income spent increases, the proportion of unemployed money decreases The desired results then follow Let us first explain diagrammatically how employment and national income increase

DIAGRAMMATICAL EXPLANATION OF INCREASE OF NATIONAL INCOME

In Fig 3, $C+I$ line shows the amount spent on consumption-goods and capital-goods, i.e invested.

We are already familiar with a diagram of this kind The national income is OY_1 The whole income is spent as AY_1 is equal to OY_1 by virtue of the line E making an angle of 45° with the axes. The $C+I$ line is a straight line but it could be a curved line also Investment is not shown separately here when income is OY_1, the habits of the people and technology are such as to make the economy spend the whole income on consumption-goods and capital-goods. Expenditure on capital-goods is called investment,

that is the sense in which we have throughout used that word.

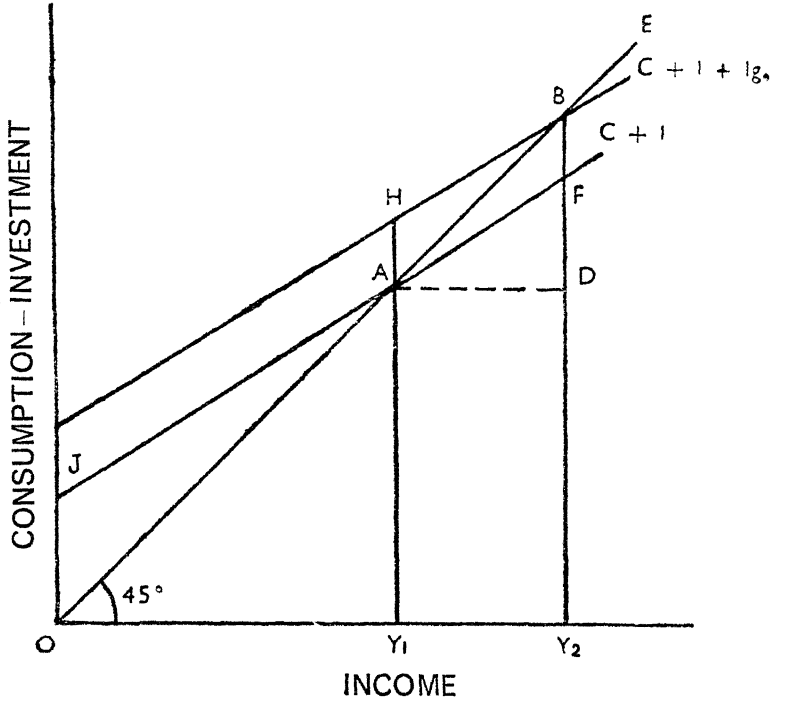


FIG 3

At the level of income OY_1, ex-hypothesis, all the factors of production are not fully employed. That is because at higher levels of income some part of money-income would remain unemployed as we explained earlier. The diagram shows that for incomes above OY_1, the line E is above the line $C+I$, showing that a part of income earned is not spent—money remains unemployed. For this reason income is restricted to a figure below the natural maximum, and consequently the factors that produce income remain unemployed.

If the government now invests some money (equal in our diagram to BF), the $C+I$ line rises to the new position $C+I+Ig$. The national income increases to OY_2 and becomes the new stable income for the community. The whole income is spent, as OY_2 is equal to BY_2. In this new position of stability of national income

there is no money unemployed, and because of higher income more factors of production are employed If the technical coefficients of production are fixed, factor-employment would increase in the same proportion as income.

PROPENSITY TO SPEND SHOWN IN THE DIAGRAM

This additional investment of money by the government is financed, as we assumed above, by the creation of new money (the money does not come from the pockets of the people). If the investment of this money goes mainly to those whose propensity to consume is great, unemployment of money (the proportion of money unemployed) would decrease It will be seen from the diagram that when the government invests the amount *BF*, the total expenditure of money increases by *HA* and this increase gradually causes increase of income, and when income becomes equal to OY_2 the entire national income is spent.

The amount of money spent remains increased throughout by *HA* because it is assumed that government-expenditure or investment is increased by the amount *HA* The final increase of income is brought about by the increase of production to meet the higher demand caused by increased spending Ultimately, an increase of income equal to Y_1Y_2 (which is equal to *BD*) is brought about. This is greater than the amount of money invested by the government according to the multiplier principle. The multiplier is determined by dividing *BD* by *BF*

It will be clear that when money income rises by more than the amount of created money, the additional supply of money must come from the monetary system. In our diagram therefore, *FD* of money has come from the banking system Some part of it can be accounted for by increased velocity of circulation of money but not the whole of it. Thus the economy, through the agency of the banking system, increases its investment This investment is called induced investment. For the multiplier (the money-multiplier) to act, it is, therefore, necessary to have an elastic credit system to facilitate induced investment.

WHEN FULL-EMPLOYMENT IS REACHED

Without government-investment some factors remain unemployed

and that is because of under-employment of money. Government-investment changes the situation by putting a larger proportion of money into the hands of those who have a higher propensity to consume. A considerable part of money invested in production goes into the pockets of labourers, and it is only when production is carried very far that additional money-income produced tends to be concentrated in the hands of the capitalist-entrepreneur class However, when government-investment reduces the percentage of unemployed money and thereby increases national income, the employment of factors of production increases. When the technical coefficients of production are fixed (which is never the case in the real world), employment increases in the same proportion as national income In our diagram employment would increase in the proportion of Y_1Y_2 to OY_1, assuming fixed coefficients of production. In any case, employment increases because we cannot produce more without employing more factors

When government-investment increases sufficiently, all the factors or almost all the factors are fully employed We say *almost all the factors* because for full-employment of all the factors what is needed is that Nature should supply us with such quantities of natural resources as are required by the technical coefficients of production. However, this point is not of much importance for us. Once full-employment level of national income is reached, there is no sense in further increasing government-investment. If, however, further investment is made, the line $C+I+Ig$ in Fig. 3 would rise to a higher position and cut the line E further to the right. That would show an increase of national income.

Here we are measuring national income in terms of money. When national income is thus measured the shifting of point B to the right would show that money-income of the community has increased. But employment cannot increase after all the factors have been employed. And if employment does not increase, real income (i e. income in terms of goods and services) also cannot increase unless technical coefficients of production are very elastic. But as these coefficients cannot become very elastic as a result of increased governmental investment, there is no likelihood of real income increasing once the resources are fully employed.

Hence, if autonomous investment increases after the full-employment level of income is reached, real income (i.e. production) cannot increase, employment cannot increase, but national income

in terms of money can increase That is the situation which we describe as inflation (of prices) With increased monetary demand for goods and services, the supply of which cannot be increased for non-availability of further supply of factors of production, prices must rise In the process that leads to rise of prices some shifting of resources from one industry to another can, however, take place And as a result of that, the economy might be able to produce a little more of some goods *at the cost of* the production of other goods.

ALGEBRAIC EXPLANATION OF INCREASED INCOME AND EMPLOYMENT

Let us now work out the problem with algebraic expressions for the $C+I$ and $C+I+Ig$ lines

The income of the producers may as before be designated by Y which is made up of expenditure on consumption-goods C and expenditure on capital-goods I Since there is government-investment of Ig, we get

$$Y = C + I + Ig \qquad (1)$$

As I is the induced investment of the economy, it bears a relation to C. Let, therefore, $C+I$ be a proportion (fixed for the sake of simplicity) of income Y We then get

$$C + I = c\,(Y) + a \qquad (2)$$

From equations (1) and (2) we get an expression for the value of Y,

$$Y = c\,(Y) + Ig + a$$

giving us the equilibrium value of Y to be

$$Y = (a + Ig)/(1 - c)$$

In the absence of government-investment Ig, the value of Y is obtained by deleting Ig from the above value of Y National income before governmental action is

$$Y = a/(1-c)$$

While national income after investment of Ig is

$$Y = (a + Ig)/(1-c)$$

National income therefore increases by $Ig/(1-c)$.

Addition to national income is $1/(1-c)$ multiple of government-investment of Ig. $1/(1-c)$ is the familiar multiplier

In the diagram, OJ is equal to a, the slope of the line $C + I$ is c (trignometrical tangent of the angle it makes with the X-axis) and HA or BF is equal to Ig. It can be worked out from these equalities that $OY_1 = a/(1-c)$ and $Y_1Y_2 = Ig/(1-c)$.

We can say here also that if at the value of national income equal to $(a + Ig)/(1-c)$ there is full-employment of all the factors of production, there is no need to increase autonomous investment If it is increased, production in real terms cannot increase, employment cannot increase, though the monetary value of both these figures of production and employment would increase. We call that inflation of prices and factor-earnings.

A word may be said here about the distinction between induced and autonomous investments. Induced investment is that investment which is necessitated by (caused by) the demand for consumption-goods. Autonomous investment is that investment which causes a demand for consumption-goods. The former is the effect and the latter the cause of demand for consumption-goods. Induced investment is, therefore, an endogenous input into the productive machinery while autonomous investment is an exogenous input In our algebraic equations, a is the autonomous part of inputs. It is autonomous because it does not vary with income or consumption. And we see that the income generated by the system in which a is autonomous, input is equal to $a/(1-c)$. Hence income is given by the autonomous input multiplied by the multiplier which is the savings ratio We find the same thing in the case of Ig which is the autonomous input; the national income increases by $Ig/(1-c)$, i.e. by the autonoomus input multiplied by the same multiplier, the savings ratio.

The exogenous input a appears to be a part of the system itself and, therefore, might by some be regarded as an endogenous input. But the necessity for this input a (the irreducible minimum of consumption or consumption-cum-investment) is determined from outside the productive machinery. The rest of the consumption-investment input is currently determined by the productive machinery.

TAXATION TO REDUCE UNEMPLOYMENT OF MONEY

Let us now see how unemployment of money can be reduced by taxing the rich and utilising the money for the benefit of the poor.

By so doing we transfer income from those who have a low propensity to consume to those who have a high propensity. We take the case of a balanced budget, i.e. one in which the whole amount of revenue raised by taxation is spent by the government. Let us study this case with the help of the diagram below.

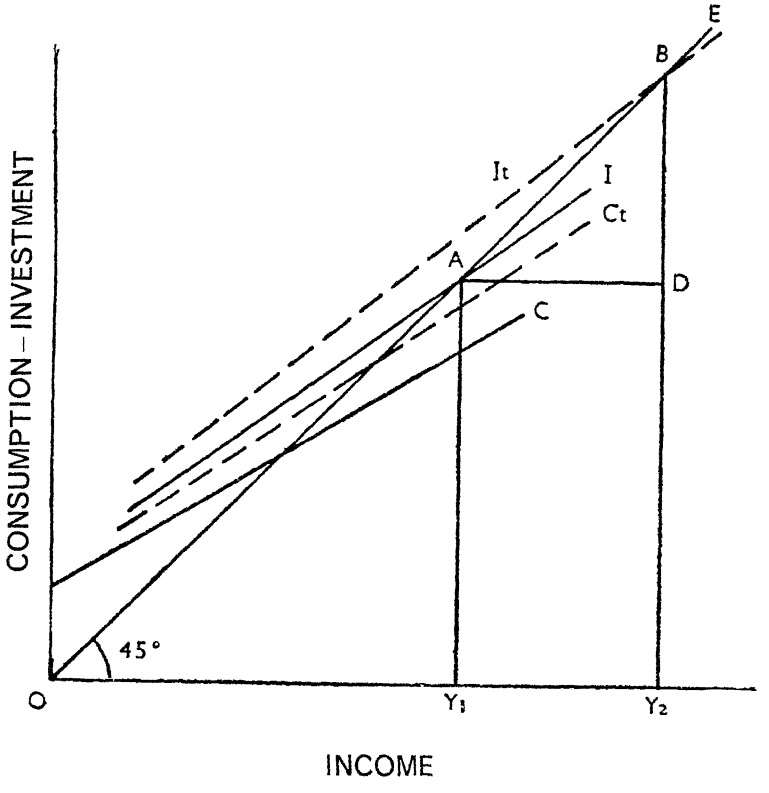


FIG 4

It is necessary now to break up the $C+I$ line into two We know that $C+I$ is made up of expenditure on consumption-goods and expenditure on capital-goods which is called investment This investment is *induced* by the demand for consumption-goods, it is an endogenous input. It varies with the expenditure on consumption-goods in a way which is determined by technology of production. In Fig. 4 we break up the $C+I$ line into two separate lines C and I. The difference (vertical distance) between the two lines

shows the amount of investment at the level of income shown by the corresponding abscissa

When taxes are levied on the rich and the money is utilised in such wise as to increase the earnings of the poor, the propensity to consume of the community as a whole rises This is depicted in the diagram by the shift of the C line to a higher position C_t We assume that investment remains the same as that is determined by technology. Since savings are reduced when consumption is increased, we shall have to allow for borrowing unless government spending is such as to make up for the deficiency. The I line above the C line now occupies the new position I_t above the line Ct

The I line cuts the E line at the point A and gives us the stable national income OY_1 The I_t line cuts the E line at the point B giving us the new stable national income OY_2 The increase of income is Y_1Y_2. Let us, however, take the case in which the tax revenue becomes investment and a good part of which, as in all previous cases, goes to people with high propensity to consume.

Let us draw another diagram to illustrate this case. In Fig. 5 the line C shows the amount spent on consumption-goods and the I line shows the amount spent on consumption-goods plus that spent on capital-goods The vertical distance between the two lines shows the investment The stable national income is OY_1 as before.

Now, let the government levy a tax in amount equal to TY_1. That reduces the income to OT of which TH is spent on consumption-goods Draw KY_1 equal to HT. Then K is a point on the new C line after tax which we call C_t. The new line C_t is shown as a broken line in the diagram. Let us superimpose on it the old investment and then add to it additional investment equal to the tax TY_1. We then get line I_t showing the amount spent on consumption-goods and capital-goods after the budget operations.

The line I_t cuts the line E at point B giving us OY_2 as national income after government-investment financed out of tax revenue. The increase of income Y_1Y_2 is equal to AD which is equal to BD. BD is equal to $BF+FD$. And by construction BF=tax revenue$-JK$. Notice that the vertical distance between the lines C and C_t is throughout equal to JK. Hence $BF=t-ct$, where t is the tax revenue and c the slope of the line C.

The line I has a steeper slope than the line C because investment

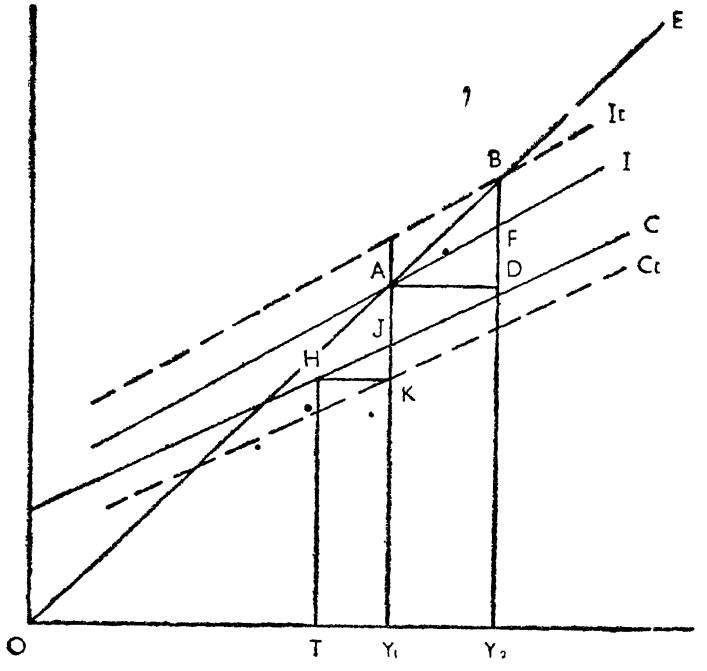


FIG 5

is greater, the greater is national income. In most books investment is taken to be invariant with income and thus made autonomous. That is objectionable. But if we also make the slopes equal, then FD becomes equal to $c.AD$ which is equal to $c\,BD$. Hence we get the following relationships.

$$Y_1Y_2=AD=BD=BF+FD=t-ct+cBD$$

hence, $$BD\,(1-c)=t-ct$$

or $$BD=\frac{t-ct}{1-c}=\text{increase of national income}$$

The increase of income brought about by government-investment financed by taxes is a multiple of $(t-ct)$, the multiplier being once again $1/(1-c)$, the savings ratio. But it will be seen from the expression for increase of income that it is equal to the tax revenue t. Hence, when the government invests an amount equal to t and keeps the budget balanced the income-multiplier is 1

Here also the same arguments hold in regard to the employment of factors. If and when increased production secures full-employ-

ment for factors of production nothing more can be gained for the economy by further increasing investments, the economy becomes saturated with investment. Any increase of investment would then exhaust itself in inflating money-values of the variables of the system. Prices of goods and services would rise, though not equally.

ALGEBRAIC EXPLANATION OF BALANCED-BUDGET MULTIPLIER

Let us proceed algebraically now. Income Y is made up of expenditure on consumption-goods (C) and induced investment of the expenditure on capital-goods (I) required to satisfy the demand for consumption-goods. This induced investment varies with income and must, therefore, be a function of it But following usual practice we take it to be a constant amount I. The expenditure on consumption-goods varies with income and also has an autonomous element. We can express these relationships by the following equations.

$$Y = C + I$$
$$C = cY + a$$

From these equations we get the value of Y to be $(I+a)/(1-c)$.

Now let the government levy a tax, yielding revenue t and let it invest that amount as before. Consumption then becomes equal to

$$C = c\,(Y - t) + a$$

and investment becomes $I + t$

National income becomes $Yt = (a + I + t - ct)/(1 - c)$

The increase of national income $Yt - Y$, therefore, equals

$$\frac{t - ct}{1 - c} =$$

We get the same value for increment of national income. The multiplier is 1.

We have seen how it is that the balanced-budget multiplier is made to take the value 1. That is by assuming that investment (non-governmental) is fixed and thus making it autonomous instead of induced. Let us now see by how much income would increase when investment is a function of income. Let expenditure on consumption-goods be as before

$$C = c\,(Y - t) + a \text{ after taxation}$$

and let investment be

$$It = bY + t$$

From these equations we get

$$Yt = c\,(Y - t) + a + b\,Y + t$$

giving us the value of

$$Yt = \frac{a + t - ct}{1 - c - b}$$

The increase of national income is therefore

$$Yt - Y = \frac{t\,(1 - c)}{1 - c - b} = \frac{t}{1 - \dfrac{b}{1 - c}}$$

Thus, when induced investment is treated as really induced so that it increases with national income, the balanced-budget multiplier is greater than 1 If, for example, the propensity to save is 1/5 and the investment coefficient (b) is 1/10, the increase of income comes to $2t$ The multiplier is 2.

CHAPTER 7

FLUCTUATIONS OF NATIONAL INCOME

FLUCTUATIONS VERSUS CHANGE

WE HAVE finished our study of stable national income National income is said to be stable when it remains at the same level year after year. Like everything else an economy too has its beginning In the beginning its national income is in the process of adjusting itself to the determinants of employment and production. Once such adjustments are completed, national income finds a stable level for itself. This happens, however, when the variables of the economic system are such as to make stability of income a possibility.

In the last few chapters we assumed that it was possible for income to be stable ; and then we studied the economy from the point of view of that ultimate position of stability. As we saw, however, in Chapter 3, national income in actual practice seldom remains stable. There are several ways in which it can change. The change may operate continuously in one direction with the rate of change varying in various ways. Or, alternatively, it may change its direction from time to time. In an economy that is subject to all kinds of influence acting on it from within and without, it is difficult to say in what precise manner its national income would vary during any period of time.

When changes are always in the same direction, i.e when national income is either continuously rising or falling, it is said to be a case of *growth* (decline being negative growth) of national income. A fluctuating national income is one in which changes keep on taking turns, as it were. For some time national income keeps on increasing after which it begins to decrease only to increase once again after a lapse of time. Such fluctuations occur during the course of a trade cycle. It is easier for us to imagine fluctuating national income than a continuously growing one. We are concerned with the study of fluctuations of national income in this chapter.

CAUSE OF FLUCTUATION

If the national income of a country fluctuates it must be because of fluctuations of its determinants, *viz.* the use of factors of production. When the quality of factors is fixed and so also the technical coefficients of production, every change in national income is matched by a corresponding change in the use of factors of production. But, as we had an occasion to mention, neither can the qualities of factors nor the coefficients of production remain quite fixed. However, unless there is some change in the use of factors of production there can be no change in production. If national income fluctuates it must be because of similar (though not identical) fluctuations in the employment of productive resources. We have not said here anything about the ultimate forces that bring about changes in the employment of factors of production

In an economic system there are consumers and producers Production is immediately determined by producers' activities but it is remotely and finally determined by the wants and demands of consumers But while consumers' demand is the ultimate force behind production, it has to operate through the behaviour of producers and it is there that it gets either damped or whipped up. Consumers' demand has thus to face varieties of obstacles. Some of these are natural, some partially natural and others entirely man-created In the first category we have land, in the second category, technology of production, and, in the third, the psychology of producers.

Thus it is that forces operating through the production side and through the consumption side determine the course of an economy. The use of available factors of production is governed by the forces that emanate from the consumption side and have to pass through the production side For fluctuations of national income we have to look to these forces.

FLUCTUATIONS NEED TURNING POINTS

Imagine a position of stability for an economy If some change takes place somewhere, it must cause a change in national income. If it rises, it might continue to rise or stop rising at some point If it falls, it must continue to fall or stop falling at some stage. In neither case do we get fluctuating income. For fluctuations we

require the income to turn round, both, when it has reached a certain height and when it has sunk to a certain depth If the income has to take a turn, some counteracting force has to come into the picture. The forces that push up the income must encounter some counteracting force or forces to make the income take a turn. The forces that push down the income must also ultimately encounter similar opposition.

Besides the forces that give a push to national income in a certain direction, we need, therefore, others that will operate in the reverse direction. And these opposing forces must be endogenously determined—the forces causing a rise or decline of income must themselves, directly or indirectly, generate counteracting forces to ensure recurring cycles.

These counteracting forces are sometimes produced by a system in the normal course of its journey upwards or downwards and sometimes they are produced when the inflated or deflated economy bumps against some walls. These walls are called in economics the ceiling and the floor. What precisely these ceilings and floors are we shall see presently.

INCOME VARIATIONS ENCOUNTERING THE CEILING AND THE FLOOR

Suppose that due to some initial force acting on the system, income has started rising. If there is no built-in mechanism in the system due to which it stops rising, it will go on rising till a *ceiling* is reached. The ceiling, according to economists like J. R Hicks, is provided by full-employment of factors of production. When there are no more factors to employ, production cannot increase further. If producers, due to some psychological reasons, continue to attempt to increase production it would result only in the rise of prices of goods and factor-services. This rise may be uneven in extent and may also be unevenly timed with the result that production might prove profitable. But this state of affairs cannot last. Sooner or later (sooner rather than later) further production must come to an end and so fresh investment would stop. In technical language, the accelerator would disappear. But as we have not yet introduced the accelerator to the reader let us not use that word here. Further investment stops and so the multiplier-effect exhausts itself. It is at this stage that some disinvestment

is likely to take place encouraged by business psychology. Since disinvestment is negative investment, the multiplier would now become negative and income would start falling The turning point would begin to exhibit itself

The income now continues to fall as it had previously continued to rise. After a time this fall of income encounters the *floor* The floor is provided by the minimum limit to disinvestment Producers cannot disinvest without limit There are technical-cum-business limits to disinvestment Disinvestment consists in not replacing worn-out capital-goods. But one cannot go on that way till all the equipments have disappeared Some investment at that stage becomes called for and encouraged by business psychology, producers begin to make some investment. Once that happens the multiplier comes into operation. This time it is positive and income begins to rise

But this rise of income will once again encounter the ceiling and when income begins to fall it must be prepared again to knock its head against the floor. The built-in mechanism as it were, pushes the income up or down and keeps on pushing it. The turning points are the result of external factors as it were They are not external to the economic system, for, investment and disinvestment are endogenous phenomena But, for the model which economists build, these ceilings and floors are exogenous factors as they are not made to appear explicitly as variables in the mathematical equations

THE MOVING MULTIPLIER

Income increases step by step till it encounters the ceiling of capacity production, it then takes a turn, begins to diminish by stages till its further diminution is arrested by the floor provided by the minimum limit to disinvestment. During its variations income is under the influence of the multiplier which assumes dynamic character. So far we were concerned with a static picture of the economy and so our concept of the multiplier was also static Now that we are taking up the case of changing income, the concept of a moving or dynamic multiplier comes up for consideration Let us see what it is

Let us bring time-lag into the picture now Income is earned before it is spent. Let us suppose, therefore that income of period

1 becomes available for consumption in period 2. Let investment be autonomous so that the question of time-lag does not come in. We then have the following equations.

$$Y_t = C_t + I_t$$
$$C_t = c(Y_{t-1})$$

From these two equations we get the value of income as

$$Y_t = c(Y_{t-1}) + I_t$$

Let us include for the sake of convenience induced investment in the expression $c(Y_{t-1})$ and likewise let us suppose that autonomous consumption (which we represented by a in previous cases) is included in our autonomous investment here designated by I_t. We then work out the case in the following manner.

$$Y_t - cY_{t-1} = I_t \qquad (1)$$

Since I_t is constant we might as well replace it by I

When the multiplier has worked itself out fully it will have the final static value and thereafter it would matter little whether it is period t or any other period. Let at that stage the value of income be $\bar{Y}$. Whenever we make a variable constant, we signify it by putting a line over it.

From equation (1) we then get by substitution

$$\bar{Y} = \frac{I}{1-c} \qquad (2)$$

1 $(1-c)$ is the familiar static multiplier.

From equation (1) we get

$$Y_1 - cY_o = I$$
$$Y_2 - cY_1 = I$$
$$\therefore \quad Y_2 - c(I + cY_o) = I$$

Similarly

$$Y_3 - c\{c(I + cY_o) + I\} = I$$
$$\therefore \quad Y_3 = c^2(1-c)\bar{Y} + c^3\bar{Y}_o + c(1-c)\bar{Y} + (1-c)\bar{Y}$$

by substituting the value of I from equation (2).

Hence $$Y_3 = c^3(Y_o - \bar{Y}) + \bar{Y}$$

Generalising,

$$Y_t = c^t(Y_o - \bar{Y}) + \bar{Y}$$

This equation shows that as time goes on, national income approaches the final static value here represented by $\bar{Y}$. Y_0 is the initial value of national income so that gradually income rises or falls according as the income, to start with, is lower or higher than the static stable value Here, then, we have an equation that shows the process of adjustment in an economy giving us the path of income as it approaches the stable value The multiplier acts by stages and in the meantime income tries to reach its desideratum, as it were This process of adjustment is due to the time-lag in consumption

TIME-LAGS

We have seen how when income is increasing or decreasing steadily, the existence of ceilings and floors can cause it to reverse its direction and thus give to the economy a fluctuating national income. These dead-walls at the upper and lower ends combined with the action of the multiplier make the income fluctuate without a pause We then saw how, when there is a time-lag in consumption, income tends to increase or to decrease Since we have introduced the notion of time-lag, let us mention here other time-lags in the operation of a system

The consumption time-lag consists in the income earners' spending their income *after* it is received and not during the period of time to which the income belongs. The period of time may be small or big If the time-lag is small, the same number of periods would take a smaller time (clock-time) to give us any particular figure of income. The turning points would be more quickly reached

Besides consumption time-lag there is production time-lag An interval of time passes between the receipt of income by producers and its investment (of a part of it) in production This depends on the habits of businessmen and also on their psychological reaction to the prospects of making a profit When business is looking up producers invest money quickly, even in anticipation of demand. But when business is dull producers become more cautious and investment in business (over and above what is strictly necessary) is made only when demand has actually increased

Then there is technological time-lag. Some time is needed for production to increase after investment. In some industries the

time-lag is very small but in most modern industries the time-lag is of a considerable dimension. All these time-lags make an economy run its course with jerks or with disappointed expectations. That is why there are either delayed changes in the same direction or changes in alternating directions

Besides the above time-lags there is another which is due to a delayed response of a production unit to change of price. This case comes under the study of what is called the cobweb theorem. When an economy is adjusting itself to changed conditions these adjustments express themselves in many ways and one of them is variation of the price level. In a money-economy the impact of all adjustments is on the price. If consumers respond to price-changes at once but producers' supply takes time to respond, there are fluctuations in price and production and, therefore, in income also In such a case, under certain given conditions, the price (the price-level if we take a macro point of view) goes up and down without having to encounter a ceiling or a floor. Let us then take up this case now, for, it is one in which fluctuations are caused by a built-in mechanism as it were.

UNSYNCHRONISED SUPPLY AND PRICE CHANGES

After having shown how the *terminal walls* (ceilings and floors), aided by the multipielr, cause fluctuations in income, let us now show how a particular kind of time-lag can make price, output and income fluctuate.

Let us suppose that demand responds to price at once or in the same period while supply responds to it with a lag of one-unit period. That is, let us suppose that the demand in period t is a function of price in the same period while supply in period t is a function of price in the preceding period $t-1$.

Hence,

$$D_t = P_t$$

and

$$S_t = P_{t-1}$$

In order to solve the equations, let us give them the following simple shape,

$$D_t = ap_t + a' \text{ and } S_t = bp_{t-1} + b'$$

When final equilibrium is reached, $D_t=S_t=ap_t+a^1=bp_{t-1}+b^1$ where there is no distinction of time We can, therefore dispense with t's and get

$$P=\frac{b^1-a^1}{a-b} \text{ and } D=S=\frac{ab^1-ba^1}{a-b}$$

Now to get the path traced by the price, we equate

$$ap_t+a^1 \text{ to } bp_{t-1}+b^1 \text{ and get}$$

$$p_t=\frac{b}{a}p_{t-1}+\frac{b^1-a^1}{a}$$

$$p_1=\frac{b}{a}p_0+\frac{b^1-a^1}{a}$$

$$p_2=\frac{b}{a}p_1+\frac{b^1-a^1}{a}$$

$$=\left(\frac{b}{a}\right)^2p_0+p\frac{b^1-a^1}{a}\left(\frac{b}{a}+1\right)$$

$$=\left(\frac{b}{a}\right)^2p_0+\bar{p}\left(\frac{a-b}{a}\right)\left(\frac{b}{a}+1\right)$$

where $\bar{p}$ is the final equilibrium price $\frac{b^1-a^1}{a-b}$

$$=\left(\frac{b}{a}\right)^2p_0+\bar{p}\left(1-\frac{b}{a}\right)\left(1+\frac{b}{a}\right)$$

$$=\left(\frac{b}{a}\right)^2p_0+\bar{p}\left\{1-\left(\frac{b}{a}\right)^2\right\}$$

$$=\left(\frac{b}{a}\right)^2\left(p_0-\bar{p}\right)+\bar{p}$$

Generalising, $p_t=\left(\frac{b}{a}\right)^t\left(p_0-\bar{p}\right)+\bar{p}$

Since a is normally negative and b positive, b/a is negative so that $(b/a)^t$ becomes alternately positive and negative

It will be further seen that if b/a is arithmetically greater than 1, the price tends to infinity, positive or negative. Where b/a is equal to minus 1, price oscillates with a fixed amplitude. When b/a is arithmetically less than 1, price oscillates, the amplitude getting less and less, and tends to the final equilibrium level

$$\frac{b^1-a^1}{a-b}.$$

Professor R.G.D. Allen has given some interesting variations of

this case of fluctuations caused by the time-lag of the kind considered here. In the above case, we repeat, no ceiling or floor is needed to give a turn to income. There is, as it were, a built-in device in the economic system by virtue of which income keeps on fluctuating.

FROM STABILITY TO FLUCTUATIONS THROUGH TIME-LAGS

We took up a few cases of fluctuation in the previous section. Some of these fluctuations were caused by time-lags with terminal barriers, while one was caused merely by a particular type of time-lag. We also saw how the multiplier increases income. If the multiplier is k, an investment of I increases income by $k.I$. This means that when the economy has stabilised itself and all movements of variables have come to a halt, the income is seen to be k times the additional investment. In such an explanation we jump, as it were, from the initial position of equilibrium to the final position, or the new position, of equilibrium. The original stability is transformed into a new stability-position by the introduction of fresh demand for capital-goods. In economics this type of analysis is called *comparative statics* The static position of the economy at one time and in one set of circumstances is compared with its static position at another point of time or in another set of circumstances. We do not imply thereby that the economy actually jumps to that new position of stability. The economy must reach the new position by steps; but we ignore such step-by-step adjustment of the system to changed conditions.

In reality however, the economic system attains many intermediate positions of temporary equilibrium before it finally settles down to a new stable equilibrium position. The manner in which it does that—the quickness with which it marches towards its final destination—depends on the time-lags. It is because of the time-*lags* that these intermediate positions of equilibrium are attained by the system. The lags are responsible for the various *halts* of the system on the path to the final stability position.

In the case of consumption time-lag we saw that the smaller the time-lag the shorter is the time taken by an economy to reach the turning points. In cases in which there is no turning point the final stability position is, therefore, reached more quickly, the smaller is the time-lag. When the time-lag in the limiting case becomes

zero the economy reaches the new stable position *at once* The analysis therefore, becomes timeless or static when there are no time-lags. It is thus because of these time-lags that we experience fluctuations, it is through time-lags that we pass on to fluctuations from stability.

Keynes' multiplier is said to be static for the reason that he ignores the time that adjustments take to establish the full value for the multiplier Keynes' theory is called static for other reasons also He has abstracted from all changes in the technique of production and the other variables of the system on the side of production Such an abstraction has its own advantage, it simplifies our understanding of certain fundamental forces that operate on the economic system As a first approximation such simplifying assumptions are in order

FLUCTUATIONS AND GROWTH—TWO ASPECTS OF A CHANGING ECONOMY

We have taken up above some cases of fluctuations of national income. There are others that are mingled with those of growth. When an economy is dynamic it is so because of some forces acting on it from within or from without These forces cause a change in the use of factors of production They may act directly on the supply or production side, or they may act on it through the demand side But in any case output increases or decreases Concentrating on the increase of output it will be observed that in all such cases of increase not only is a fuller use of given factors of production involved, there is involved also a better use of them A better use changes the quality and character of factors—there follows an improvement in the technique of production Due to such a developed technique the production-potentiality of the economic system increases—growth follows

Due to lags and other hindrances the progress in upward direction is, however, never smooth and even There are ups and downs in production and in other variables which We have called fluctuations. When we take up the study of *growth* we shall, therefore, have an occasion to consider other types of fluctuations

CHAPTER 8

FLUCTUATIONS OF INCOME—MONETARY AND REAL

REAL INCOME AND MONEY-INCOME

WE HAVE already observed that income is best conceived of in terms of satisfaction but it is not possible to measure it when it is so conceived. When income is understood to consist of goods it is possible to measure it, but as goods are of diverse kinds it is not possible to compare the income of one period with that of another when the composition of goods-income changes. For this reason it has become necessary for us to conceive of and measure income in terms of money—either the money that buyers earn as their income or the money that the sellers get as their income These two are earned in different but successive periods of time. In the case of a stable, stationary economy the two money-incomes are equal.

When income is understood to consist of goods (and services), it is called real income. Its money counterpart is called money-income. When real income rises money-income should also rise and if it does not rise, or if it rises less or more than real income, it gives us a wrong measure of real income. In other words, money should be neutral so that it may faithfully indicate the changes in real income Money is a measuring rod and like other measuring rods it should itself remain constant in size Actually the peculiarity of this measuring rod makes it most unstable. We measure goods not in terms of a unit of money of constant *dimensions*, we measure them, instead, by comparing their quantity with the quantity of money in use in the economy. And this quantity keeps on varying in a money-economy.

When money-income varies in the same proportion as real income money is said to be neutral. When money-income increases faster than real income there is said to be inflation (of money or prices) When money-income rises less rapidly than real income there is said to be deflation (of money or prices). It is not always possible to say whether money-income has varied in

the same proportion as real income When all goods vary in supply in the same proportion it can be calculated whether the change in money-income is proportional to that in real income, but not otherwise

INFLATION AND DEFLATION

It is not necessary to go into the details of the problem of defining inflation and deflation Suffice it to note here that when money ceases to be neutral, when it ceases to be a constant measuring rod prices tend to be inflated or deflated When these words are so defined inflation and deflation can be seen to be due to a relative increase or decrease of the supply of money The word relative is important in this context for it then covers the cases of cost-push and demand-pull inflations

Since price expresses a relationship between the quantity of money and the quantity of goods whenever the ratio of one to the other is disturbed, inflation or deflation results as a consequence. It matters little whether the change of ratio is caused by a change in the quantity of goods or the quantity of money or unmatched changes in both, whenever a relative change in the quantity of money takes place, there results inflation or deflation If the quantity of goods increases we expect money also to increase correspondingly since money is our servant and its only function is to serve as a measuring rod

When, therefore, prices rise we can say that there is inflation and when prices fall we can say that there is deflation. With such changes in prices of goods the prices of services (factors of production) also change And because of that, employment also naturally changes In a closely-knit economic system, a change in one variable induces changes in all other variables. The percolating effect of such a change in one variable of the system has its beneficial effects; it facilitates the needed adjustments in the various economic forces

With inflated values of saleable goods and services or with their deflated values, a change in the distribution-pattern always occurs That is because all prices do not rise uniformly. In general, during the inflationary phase of an economy, producers (capitalist-entrepreneurs) have an advantage over labourers Wages have a tendency to lag behind the rise of prices (of goods). Further,

when prices are rising, since the value of money is falling, borrowers have an advantage over lenders.

It will be clear from the way we have defined inflation that it is possible for real national income to rise during a period of inflation (of prices). For, to repeat, inflation merely implies a more rapid rise of prices than of output.

DEMAND-CAUSED AND SUPPLY-CAUSED INFLATION

Inflation, like anything else, must have a cause. There must occur some change somewhere in an economy to cause money-supply to change in a greater proportion than goods (services always included). We can imagine an economy that is stable in the sense that it has attained the position of equilibrium so that the producers do not find it necessary either to increase or to decrease output. In such a state of the economy a certain price level obtains, determined by the supply of goods produced and the supply of money available for purposes of buying it. We need not complicate matters by allowing ourselves to think of velocity of circulation. It can be assumed to be constant or else to be subsumed by the concept of supply of money.

If at this stage something occurs to disturb this equilibrium, its impact must be felt in all sectors of the economy. Suppose the demand for goods in general increases. Demand can increase due to the influence of various factors If we do not allow for the entry of buyers into the system from an exogenous source, demand can increase due to the decision of consumers to buy more and allow their cash-balance to get depleted This can happen due to a change in the psychology of the people. If, when an economy is in a normally stable equilibrium position, such a change occurs we have to look for its cause to the action of some exogenous force. Unless some force begins to act on the system its natural poise cannot be disturbed. Let us not bother about the cause of increase of demand. If demand for goods increases, and it can increase by the decrease of cash-balances, it must produce sympathetic changes elsewhere. The first effect would be to raise prices. The secondary effect would be to increase production (under certain conditions) *via* the increase of investment. This requires an elastic supply of credit. Granting that, the next effect would be to employ more factors and perhaps to offer them higher remuneration. At this

stage, when supply has increased to meet to an extent the initial increase of demand, prices must register a fall which will be greater the larger is the increase in the supply of goods.

In this way a change at one place will cause a change in the other and so on till a new position of equilibrium is reached. But during the process of adjustment while the supply of goods increases in response to increased demand, the supply of money also increases And this additional supply goes into the pockets of consumers to further increase the demand for goods. As a matter of fact, the initial increase of demand sets the multiplier principle into operation. Income increases, output of goods increases, the supply of money increases and the price level also rises Mathematically it is arguable that if the supply of goods increases in proportion to the increase of money, the general level of prices would remain unchanged. But such a thing is most unlikely to happen and is perhaps ruled out by theory also. Money cannot remain neutral in the process of adjustment. Everything proceeds in the upward direction, money included, inflation follows as a result Inflation brought about by such an initial pull given to the system by the rise of demand has come to be known as demand-pull inflation. We can, to use more direct language, call it demand-caused inflation.

Now let us explain supply-caused inflation. Starting from the position of stable national income, let us suppose that the cost of production rises. Labourers might demand higher wages or the banks might charge higher rates of interest. Such changes also need some force to act on the variables of the system A system that is in poise cannot be disturbed in the absence of an exogenous force operating on it from without. This point too we need not labour. It is sufficient for our purpose to note that a disturbing force now acts initially on the supply side. Suppose wages rise; the cost of production rises Producers now cut down their output unless they are able to demand higher prices. If the increased injection of money into the system through higher payments to labourers raises the propensity to consume, the multiplier effect comes once again into operation. This will need an elastic supply of money. Given such an elasticity and given a higher propensity to consume, the effect would be the same as in the case of an increase of autonomous investment.

Again, all the variables of the system assume new values. Costs

rise. incomes increase, demand goes up and prices rise. In this case, as also in the one just considered, production of goods and the supply of money both increase. It is most reasonable to assume that money-incomes rise faster than real incomes ; according to our definition there is inflation. It can be shown in a similar way that when monetary demand for goods falls or the cost of production is somehow lowered, a chain of reactions follows in the direction opposite to the previous one and deflation results as a consequence.

INFLATION OF MONEY-INCOME WITHOUT INCREASE OF REAL INCOME

When there is stability of national income with full-employment of productive factors, inflation, when it occurs, is of a different kind. After full-employment there cannot be more employment and so there is no possibility for production to increase. Real income becomes inelastic. Hence, if anything happens to the system that makes money-supply elastic and if as a result money-incomes rise, there is no sympathetic rise in real income. At the full-employment equilibrium level of national income there is the maximum possible real income with a certain amount of money-income and a certain price level. Now, if due to some reason, monetary demand for goods increases, i e. when the propensity to buy consumer's goods increases, the multiplier effect begins to operate. But now the real side of the economy does not respond to this effect. The influences acting through money exhaust themselves, as it were, on the monetary plane Prices of goods rise, incomes rise the supply of money increases but production does not increase. This time, then, there is no increase of goods to be set against an inflated supply of money. There is inflation, more severe than in the previous cases. In the previous cases inflation of prices had the tendency partly to exhaust itself in the increase of goods. In this case the influences acting on the system in the direction of increasing real income have a tendency to exhaust themselves on the monetary plane through rise of prices.

This type of inflation is more troublesome, for there is nothing here to act as a check on the rise of prices. Eventually a check comes into operation but perhaps not before a good deal of damage has already been done. In normal circumstances inflation is not

likely, to continue indefinitely after full-employment of productive resources. For, as we have already seen, full-employment acts as a ceiling to further activity and the multiplier effect wears itself out and ultimately becomes negative But all this can be predicated of an economy that functions under normal circumstances. But circumstances may not always be normal, the government might continue to invest money Such investments autonomous in nature, act as exogenous forces to keep up the rate of inflation Eventually hyperinflation of prices follows

Such cases of inflation (or deflation) with full-employment of resources can be diagrammatically illustrated but such illustrations do not add to our understanding of the forces that bring about inflation

It is worth noting that all the trouble can be attributed to time-lags in the economic system Money goes from the pockets of producers to the pockets of factors of production and some time elapses before it is returned to the original pockets This interval of time is a function of many variables such as the system of making payments to factors, the spending habits of the people and the system of selling goods. But so long as money functions as a medium of exchange and so long as production takes time and, further, so long as there is division of labour, time-lags will be there. Adjustments in economic activities are, therefore, never instantaneous. And that explains why inflation can in certain circumstances *run away with us.*

CHECKS AND REMEDIES

We have seen how inflation can be caused by an initial change introduced on the side of demand or on the side of supply Prices get inflated when people demand more goods and also when they demand more money. But this distinction between the demand-caused (demand-pull) and supply-caused (cost-push) inflations can be maintained only when we look at the starting point Once inflation has set in, the two causes act and react on each other. Increased demand for goods increases profits, increased profits induce increased production, increased production requires an effort on the part of producers to secure more factors of production and, therefore, to offer them higher remunerations and higher prices induce factors of production to demand higher payments.

In a firmly-joined economic system every action must produce a reaction. Demand-caused inflation gives rise to supply-caused inflation and *vice versa*.

From whatever point of view one looks at inflation one finds that a necessary objective condition for it is, as we have already explained, a relative increase of the supply of money. The word *money* is, however, capable of various interpretations. One can include in money deposits or credit or can exclude them from it. The word money can be used in the sense of a *stock* (the Cambridge sense) or in that of a *flow* (the Fisherian sense). Thus, supply of money might mean only the coins and notes in the possession of a community or it might mean such media of exchange multiplied by their velocity.

In a rough way it can be said, however, that there can be no inflation unless there is a relative increase of money, i.e. unless money increases faster than goods. When we look at such a manifestation of inflation the appropriate remedy suggests itself to us. Something must be done to reduce this relative increase of money; and that can be done by decreasing the supply of money or increasing that of goods In some cases it is easy to operate on the supply of money; in others, on the supply of goods.

The supply of money can be decreased by striking at the source of money. That can be done by making credit, or borrowing, a more costly affair. If the monetary authorities make money dear by raising the rate of interest, there would be less injection of money into the system. We need not bother to see how actually such a policy would reduce the supply of money. It is clear, however, that anything we can do to make it less attractive to borrow and invest money would have a salutary effect on the rise of prices. To what extent such a policy would be successful depends on the initial cause of inflation, though it is obvious that regardless of the initial cause restriction of credit would have some effect at least on rising prices. Dear money would make investment less profitable. But it has to be sufficiently dear if it has to fight forces that encourage increased production. Production increases because it becomes more profitable. To remind ourselves actually real income does not increase after the stage of full-employent of resources but money-income continues to increase and we have then attempts by producers to keep up production: instead of production increasing it is prevented from decreasing.

It is, however, only theoritically correct to suppose that after full-employment production stops increasing. The limits to full-employment are stretchable and production consequently is never very strictly inelastic after the so-called level of full-employment is reached. Hence, when prices are rising due to increased monetary demand pitched against a constant or slowly increasing supply of goods, forces begin to operate to stretch the full-employment level and make it thereby possible to increase output. To damp the enthusiasm of producers one has to raise the cost of production and that can be done, in one way, by making capital more expensive to use. Dear money policy commends itself

Our economic system is not as simple as we take it to be Every action, as we have observed earlier, produces a reaction, when money becomes dear it produces a reaction The same volume of money is put to harder work. When more labourers cannot be employed producers make the same labourers work harder In the same way, when producers cannot borrow more money and the system is confronted with a smaller (not increasing) supply of money, it takes more work from the restricted supply. The velocity of money increases; it becomes the counteracting force. Every force tends to produce a counteracting force. But dear money must in the final analysis exert some restrictive influence on the rise of prices.

Another thing that can be done to make money relatively scarce is to prevent the existing supply of money from doing its normal work. We can force unemployment, as it were, on money. It can be made to remain unused by legislative measures. The government can prohibit purchase of goods beyond a certain limit. This is known as *controls*. Income-earners would in such cases be allowed to buy restricted quantities of goods. Besides such a measure, prices might be directly fixed. But controls by themselves have a tendency to bring prices down Money is made to remain idle and unemployed ; its velocity is reduced. This may involve much administrative work but theoretically it is a very logical approach to the problem of inflation. The dear money policy reduces the supply of money in the objective sense , controls make a part of that supply ineffective.

The third way of reducing the supply of money is to take away a part of the income of the people and sterilise it in the coffers of the government. By levying taxes the disposable income of the

people can be reduced. But the tax revenue should not be spent again by the government If that is done, what is taken away by one hand is returned to the public by another A balanced budget is of no use here A surplus budget sterilises a part of the purchasing power of the people and thereby reduces the supply of money This fiscal measure has the same effect as controls, for it also reduces the effectiveness of money as a source of demand for goods.

While dear money reduces the volume of investment, the other two methods reduce consumption. The first lowers the propensity to invest while the latter two lower the propensity to consume. Due to lower consumption-coefficient, the multiplier is weakened and income (money-income) stops increasing rapidly. The price level, therefore, is held in check. Due to lower propensity to invest the accelerator is weakened. Mounting money-demand for goods does not get adequate response from the producers. The growth of money-income is retarded and inflation is checked.

The three ways of arresting inflation explained above treat the symptoms of the disease rather than the disease itself. Inflation is seen to consist in the rise of prices which is due to the supply of money increasing faster than the supply of goods. To arrest inflation we have three methods of reducing the supply of money in active use. But money-supply does not grow by itself; it grows because there are certain human forces in operation that make the increase of money-supply attractive or profitable. Take for instance increased demand for goods. When the demand for goods increases it is satisfied or attempted to be satisfied by the expenditure of a larger amount of money. Cash-balances are reduced or consumers' credit increased. More money comes into effective use. We can introduce forces to operate on this additional supply of money, but so long as the desire to consume more continues, the supply of money will *tend* to increase though it might not get a chance to manifest itself. What is needed, therefore, is to change the psychology or the wants of the people. In what precise way that can be done, one cannot say unless one is in full possession of all the relevant facts in regard to the economic situation prevailing at the start of inflation. It might be that the check on the supply of money itself metamorphoses the psychology of the people that is responsible increased demand for goods.

The difficulty that confronts us here is at least in part due to the

fact that in a constantly changing world it is not possible to disentangle the various forces that act simultaneously to cause inflation As we said above, the demand-pull inflation and cost-push inflation act and react on each other, and it is perhaps due to this interaction between the two that inflation does not come to an automatic or speedy end.

As far as the supply side is concerned we saw how an increase of cost of production can lead to inflation. Say, for example, labourers may demand higher wages and thus raise production costs. The effect of this would then be transmitted to other sectors of the economy and ultimately inflation would result. Here the appropriate remedy lies in persuading labourers to accept lower wages or not to demand higher wages. The pressure of trade unions and collective bargaining is sometimes unjustified and demands for wages are made that cannot be sustained by the economy. In such cases cost-push inflation is the result How labourers can be persuaded to withdraw their demands we are not competent to say. Perhaps legislation would be called for in such situations. But leave the matter there.

Another way to arrest inflation is to increase real national income. We have supposed that factors of production are fully employed and that increased monetary demand cannot lead to further production. If production is quite inelastic in such situations there is no remedy available to us as far as the supply side is concerned. But, as we had occasion to mention, it is always possible to increase production though it may not always be quite profitable. That is because there is no rigid limit to the employment of factors. We can increase their effectiveness if we cannot increase their physical amounts. Better technique is not only theoretically possible, it is often encouraged and suggested by rising prices. Rising prices enable producers to make some short-period profits. But their expectations are always belied by subsequent events. It is precisely in such conditions of an economy that producers are forced, as also encouraged, to exploit all possibilities of improved technique of production. Organisation, in short, improves in quality. It is this factor that is most elastic and it is this factor that makes better use of other factors possible.

Hence, on the one hand, there are natural forces that work to increase the supply of goods and, on the other, there is the government that can play its part in improving technology. Government

investment, which would have the tendency normally to aggravate the trouble, can now be made to provide the economy with better methods of production. And if this investment is financed by taxation it would serve a two-fold purpose, it would mop up some purchasing power and thus reduce the supply of money and it would also improve the technique of production and thus increase the supply of goods.

GOVERNMENT AS THE CAUSE OF DEMAND-CAUSED INFLATION

While collective bargaining by labourers might be a potent cause of supply-caused inflation, government expenditure is often the main cause of demand-caused inflation. The power to tax the people and the power to create money are the two weapons in the hands of a government which if unwisely used can do much damage to an economy. The ease with which money can be coined or printed provides a great temptation to the government to undertake expenditure which an economy cannot sustain. Taxation does not cause inflation though it might otherwise reduce national income. But deficit finance—creation of money—can inflate prices in a way in which nothing else can. As prices rise, the government finds it difficult to discharge its obligations without increasing its revenue. The easiest way to get more money is again to create money. Thus deficit finance creates forces that make it necessary to perpetuate itself. And when the government itself is responsible for inflation it is difficult to apply normal checks. Inflation begins to feed on itself.

CHAPTER 9

GROWTH OF NATIONAL INCOME

THE PROBLEM OF MEASUREMENT

INCOME is said to grow when it increases from one period of time to another. In all studies of growth income means real income, i.e. it is measured in terms of goods and services. As it is not possible to add up things that are different in nature and character, it is difficult to find a satisfactory way of measuring real income. What we, therefore, do is to find the money-values of all the goods (and services) and then add them up. Money, then, becomes our measuring rod. But money is an elastic and variable measuring rod, that is because it has no intrinsic value, its value is derived from the utilities of goods which it is employed to measure. Hence, when we measure national income in terms of money we have to adopt a device to get over this difficulty. That device is to calculate the value of goods and services in terms of constant prices. The value of goods is measured, let us say, in the year 1961 in terms of money taking the prices as they obtain in that year. In the next year we have a different quantity of goods and to measure their value we use the same prices that obtained in 1961. This is not a very satisfactory way of measuring national income but it is perhaps of some use to us. Such a measure shows whether a nation has more income or less income it the next year assuming that the relative utilities of the various goods are the same. Relative utilities, however, are never the same. They change for various reasons ; tastes change, the composition of the population changes and the qualities of goods themselves also change. However, it is not possible to have a more satisfactory method of measuring real national income. One always experiences such difficulties where the process of aggregation has to be gone through. And such processes become unavoidable when we make a macro-study of any problem.

GROWTH IN SHORT AND LONG PERIODS

National income may increase over a short period of time and

then become constant or begin to decline. In both the cases the growth of income is a short-period phenomenon If, on the other hand, income continues to increase for long period growth becomes a long-period phenomenon. But one does not know where a short period ends and a long period begins. It is better for that reason to abandon the distinction between short and long periods and speak instead of growth that comes to an end and growth that continues for ever.

Income generally grows for some time and then declines completing one cycle of fluctuations. Such cycles repeat themselves lying across a path which is itself cyclical. But it is possible to imagine a continuous trend in these long-period cycles. The diagram on page 91 illustrates this point.

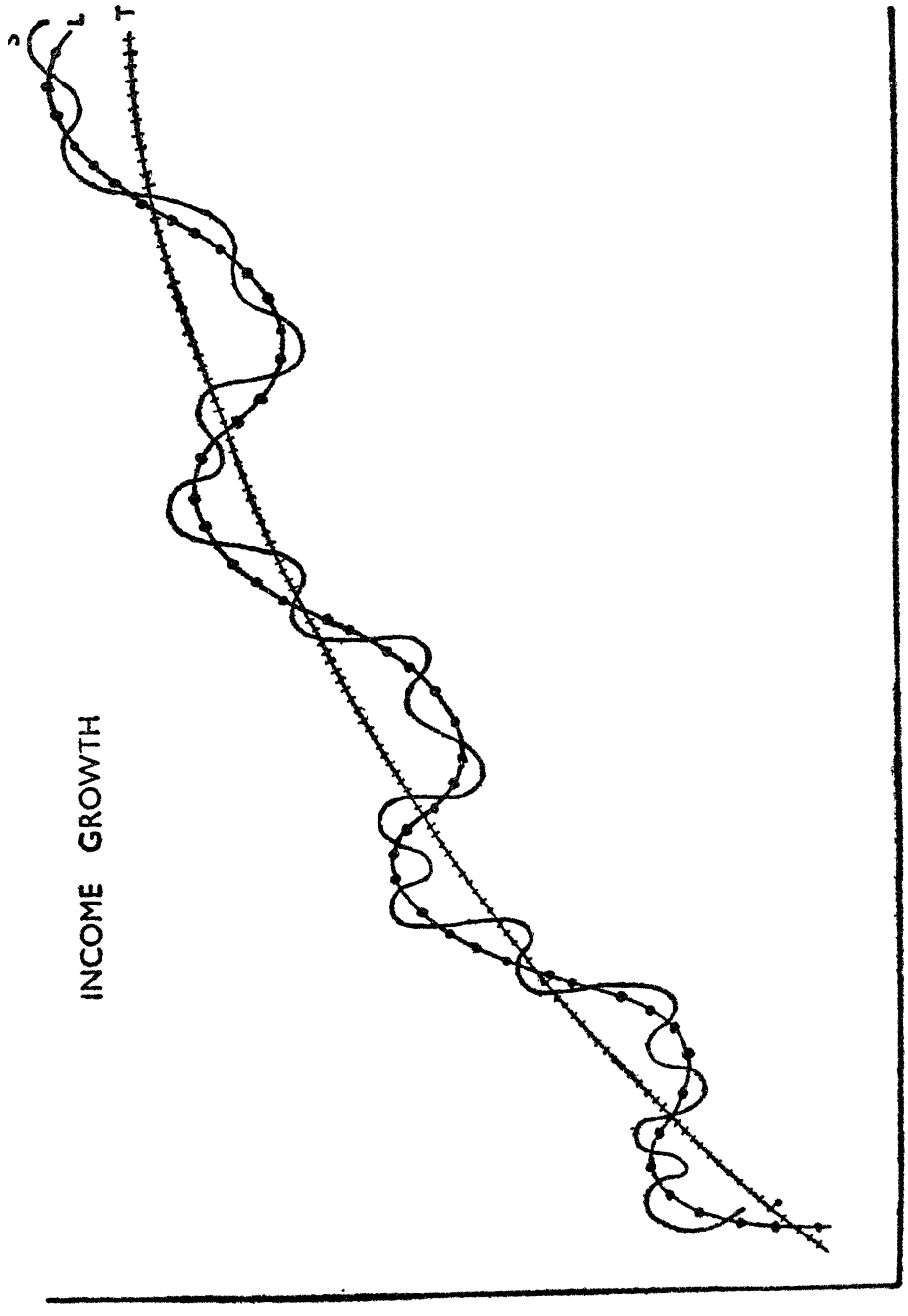
The curve T shows the long-period trend. The curve L shows long-period fluctuations and the curve S shows short-period fluctuations. It will be seen that the curve L is a trend for the small-period fluctuation depicted by the curve S.

If we confine our attention to a small period of time an ascending portion of the curve L would exhibit growth while a descending part of it would show decline of income. But when we view the behaviour of income over a long period, the curve L would reveal fluctuating income. The curve T shows a continuous growth of income, but if we could look at the behaviour of income over a very long stretch of time we would find it fluctuating, with the curve T falling and rising by turn.

This type of possible behaviour of income makes one think if income can in fact grow in a continuous fashion That it can and does fluctuate is obvious; whether it can keep on growing for ever, even with temporary fluctuations, is doubtful indeed. Our doubts are due to our imperfect knowledge of the forces that cause income to change. We have already said something about it in the chapter, "Changes in National Income : Fluctuation and Growth."

FACTORS BEHIND GROWTH

For a continuous growth of income there must be a continuous increase of inputs into the economic system. The inputs or factors can be increased in terms of their physical units or in terms of their productive efficiency. It is difficult to increase, without


INCOME GROWTH
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limit, inputs in terms of physical quantities. One can imagine Income growth curve population to grow almost without conceivable limits ; it is not difficult also to conceive of a limitless increase of capital-goods But it certainly is difficult, nay, impossible to increase the supply of Nature-given resources. That may not be a great hindrance in our way if we allow for improved technology. But if we have to rely merely on the increase of inputs measured in terms of their physical units, we cannot conceive of (continued) growth of real income. To make such a growth at all possible we have to allow for improvements the quality of factors. But the quality of factors depends on a rational use of human skill. In depends, in other words, on the extended use of the ability to plan and organise human efforts. It is organisation whose elasticity can ensure a sustained rate of growth of national income.

If there is any factor that possesses elasticity in a degree that we need for growth it is organisation. This factor, which is perhaps capable of stretching itself to any required limit, is behind growth. But circumstances must be favourable to enable it to stretch itself. These circumstances are related, in the final analysis, to the behaviour of producers (determined partly by their habits and partly by their psychological reaction to consumers' behaviour) and the behaviour of consumers.

For the study of growth it is necessary, therefore, to make some plausible assumptions about the behaviour of buyers of productive services (producers) and those of consumption-goods (consumers).

RELATION OF GROWTH AND FLUCTUATION

The forces that make for growth of income are also those that cause fluctuations, When the forces of growth are obstructed in their operation by other forces growth comes to a halt and eventually takes a turn in the reverse direction. Stoppage of growth is growth aborted; growth turned the other way is growth perverted.

Growth of national income is caused by an unobstructed operation of forces that work their way along a straight path. According to the laws of motion a force never dies out unless it meets with an opposing force. A motion has the inherent property of conserving itself. Once you give a push to the economic system so as to lead to increase of national income you can expect national income to keep on increasing. It stops only when some forces,

acting on the system from within or from without, begin to oppose the initial, causative force. When that happens, the resultant force, in certain circumstances, begins to pursue its course on a different path Decline of income is then the result. Fluctuations, we can therefore say, emanate from those very forces that cause a continuous growth of income.

It is for the above reasons that it has been maintained there can be no fluctuations without growth. Harrod has accordingly constructed a model in which cyclical fluctuations of income appear as disturbances to a steady rate of growth.

WHAT IS A MODEL?

A model of an economic system shows the relationships between some fundamental forces. An economy is a complex conglomeration of many entities, and an economic system is a network of forces that emanate from those entities. In building up a model it is necessary to concentrate on only such broad and fundamental forces as would enable us to study the features of the system we want to understand. Where it is our purpose to understand how income grows and fluctuates we must select and incorporate in our model those forces that lie at the bottom of the process of income generation.

These forces are, as they must be, macro-forces and they emanate from the supply and demand sides of the income-generating mechanism of the economic system. Thus the most important components of our model must depict the behaviour of consumers and producers. It is their behaviour that ultimately determines the variations of national income. Such behaviour of consumers and producers has relevance to certain given parameters of the economic system. Their behaviour consists, in substance, of their reactions to the forces that confront them. These confronting forces are supplied by the parametric constituents of the economic system. Some of these are truly natural while others are the resultant of the decisions taken by consumers and producers in the past. These parametric constituents of the system supply the framework within which the consumers and producers function through their behaviouristic patterns.

We expect, then, in our models some given constants that underline the important features of the economic framework and some

variables which with their relationships one to another indicate the behaviour of consumers and producers.

A model is after all a model and it is bound to be unrealistic or arbitrary in certain respects. But so long as the respects in which it is arbitrary are unimportant for our purpose it does little damage. When we construct a simple model for the economy as a whole we have to make some assumptions. The necessity for making assumptions arises from our imperfect knowledge of the working of an economic system. And when knowledge is imperfect we have to make as realistic assumptions as possible. But the assumptions must, in any case, continue to be assumptions The inferences we draw and the conclusions we arrive at after the study of our models must, therefore, be coloured by the peculiarities of our assumptions. Our conclusions are logical deductions from our premises and they are only as correct and true to life as our assumptions would allow them to be.

CHAPTER 10

GROWTH AND DYNAMIC ECONOMIC SYSTEM

GROWTH AND DYNAMICITY

FLUCTUATIONS AND growth of economic variables manifest the dynamic character of a system. It is by virtue of the static element in a system that its variables can assume constant values. So long as values are changing it is impossible to *determine* them. The "determination of dynamic values" is a contradiction in terms It is possible however, to determine *equilibrium* values of all variables; and when a system is dynamic and its components changing from time to time, we can yet determine the values that are in dynamic *equilibrium*. Here too the term dynamic equilibrium appears to involve a contradiction. But the equilibrium that is dynamic is to be conceived of in terms of states of equilibrium at succession points of time. This makes us realise that growth too is a dynamic phenomenon but that it can be conceived of as a series of static phenomena (viewed as) following one another in quick succession. It is when the human mind conceives of static phenomena in such a sequence that it creates for itself a dynamic picture. Dynamics is, thus, a running commentary on statics. Growth or fluctuations of income are, therefore, basically composed of static phenomena ordered by the mind on a temporal scale. Statics is turned into dynamics by the ability of the mind to connect the past, the present and the future. And it is by virtue of this ability that it is able to convert stable income into growing or fluctuating income. But this psychological digression should not be allowed to interfere with our understanding of what follows. Hence let us proceed.

DYNAMIC ECONOMY VERSUS DYNAMICAL SYSTEM

A dynamic economy is one the components of which are changing from time to time. From the objective point of view an economy consists of the various factors of production and the various consuming units. When these are changing the economy is said to be dynamic. Its dynamicity consists merely in the changing

picture it presents to our mind. The concept of a dynamic economy is, thus, an objective one and carries with it no subjective notions of any relationships between its various components. Such a dynamic economy can be studied from the static point of view. For purposes of such a study the picture of an economy at a point of time is examined. Since the temporal relationships between the various variables of the economy are not considered, the picture of the economy at any moment of time appears to have, or is assumed to have, an independent existence, as it were. The ties that bind the economy's position at one instant of time with that at another are ignored. When that is done the study becomes static—it becomes a static study of a changing economy.

But one can also make a dynamical study of a dynamic economy in which case the economy begins to present a picture of a dynamical *system*. The economy ceases to appear to us merely as a conglomeration of various producing and consuming units; it now appears as a number of units in certain relationship to one another. It is by virtue of the fact that now the various constituent units are viewed as acting on and reacting to one another's influences that the economy is turned into a *system*. The study of an economy viewed, then, as as a system of inter-related forces is called a dynamical study or a dynamical analysis.

In a dynamical system, therefore, which is subjected to a dynamical analysis, changes in its components depend on their initial position or state and the interval of time to which they have been exposed. The position of such a system at any moment of time can, therefore, be determined provided we know its position at the starting point and the interval of time that has elapsed since then.

Since the relationship between the components of a dynamical system are known (unless they are known there is no dynamical system,) we can calculate in what way the components would undergo a change during any period of time. The laws that govern the change are known so that no further knowledge is needed to determine the state of a dynamical system at any point of time.

DYNAMICAL SYSTEM IS CAUSAL OR ENDOGENOUS

A dynamical system of the type described above is said to be causal as the position of the economy at the starting point of time is the *cause* of its position at any subsequent time. And it is the *cause*

because it alone determines the position of the economy when it journeys over time. It is not necessary to go into the philosophical discussion of the meaning of the word *cause*. It is sufficient for our purpose to know that a cause is that which always precedes a given event. And since it always precedes the effect, the effect can be determined from the cause All the knowledge that is needed to determine an event is, therefore, to be called the cause of that event. In this sense, since to know the state of an economy at any point of time we need only to know the initial position, that initial position becomes the cause of subsequent positions The dynamical system becomes a causal (dynamical) system.

We might as well call such a system an endogenous system. For, no knowledge that belongs to the universe that is external to the system is needed to determine the manner in which the economy would behave in its journey over time The knowledge of the components and their inter-relationship is all that is needed A knowledge of endogenous forces is all that is required to trace out the path of the economy.

But no economy is quite immune to the influence of forces that operate on it from exogenous regions. That is because external forces do exist and since they exist they must exert their pressure on the economy. The position of an economy at any moment is, therefore, the result, not only of the forces that work from within, but of the forces that emanate from exogenous regions. Since the manner in which such exogenous forces operate is not known, we cannot determine a system's position at any given time. A system that is subject to such erratic unpredictable influences is called a historical (dynamical) system It is historical because the position of the economy is what it is because of its location at any particular *point of time*. Time has something to do here but we do not know in what precise way the various points of time are bound together. A point of time determines the position of the economy but not a stretch or period of time (not the time interval between the starting point and the point under consideration). The picture is a historical event at it were. The system now is not entirely endogenously determined, it is also exogenously determined.

COMBINATIONS OF DYNAMICAL AND STATICAL WITH ENDOGENOUS AND EXOGENOUS SYSTEMS

A system that is inherently dynamical can yet be treated as a

statical one by assuming that no changes are taking place in its components. A dynamical system, when it is so recognised, can be, as we have just seen, purely endogenously determined or it might be subject to exogenous influences. We can combine these various inherent or assumed features of an economy to give us four types of system. The simplest is the statical and endogenous which, to use Samuelson's terminology, can also be called statical and stationary. Then there is the statical and historical in which case changes are due to exogenous forces only After that we can combine the dynamical with the endogenous and get dynamical causal or dynamical endogenous system Here the forces that operate from within the system cause changes in the components of a system. These changes are caused by the action and reaction between the various variables. The system is one which is trying to adjust itself to the once-started change or changes in its equilibrium position. And in the end we have the dynamical and exogenous or historical system. Here the changes witnessed in the economy are caused by the forces that operate on it from an external region. We might as well allow here the influences of internal forces. These types have a theoretical interest for us. Otherwise we are interested in statical and stationary and dynamical endogenous systems. In these two cases the problem lends itself to mathematical treatment. Where exogenous forces enter into the make-up of the system no neat solution is possible. The erratic shocks introduced into dynamical models by some economists belong to exogenous influences, the laws governing whose operation are not known to us.

THE PLACE OF TIME-LAGS IN DYNAMICAL ANALYSIS

A dynamical system which is not subject to the influence of historical events is, as just seen, an endogenously determined one. The changes that occur in various variables of such a system are those that are caused by the forces that the closed system itself generates And so, as we have seen, the position of the system at one time determines its position at another. And if there has to be such a link between the position at one moment and that at the next, there must be a temporal connecting link between the variables of the system. No entity should have an existence that is independent of its particular location in time. Each entity should be born of

the past, as it were, and must in its turn give birth to the future. The connecting link is provided by making time a variable. This expression is not self-explanatory. Samuelson would say that the word *dynamical* characterises the form of a law determining the behaviour of a system in which time is a variable. Where time is not a variable, it ceases to have any influence and one can afford to take no cognizance of its existence. It is for this reason that Hicks says that in dynamics we have to *date* our variables.

The same temporal link is recognised by Ragner Frisch when he defines a dynamical system by saying that "a system is dynamical if its behaviour over time is determined by functional equations in which variables at different points of time are involved in an essential way" Since time has an influence and since it establishes a link between the past, the present and the future, the variables that enter into our equations should be referred to different moments of time. Time-lags appear in our equations. For example, the expenditure of today is dependent on the income of yesterday; the expenditure of today is born of and is determined by the income of yesterday. The functional relationship between expenditure and income is a (time-) lagged one. Equationally that is expressed as

$$E_t = {}_e Y_{t-1}$$

which purports to say that the expenditure of period or time t is a certain proportion e of the income of time $t-1$. The coefficient e may be constant or variable in which case it might as well be a function of time. Here income is said to lag behind expenditure. Such a preserved connection between variables in respect of time is needed if we have to understand a truly endogenous dynamical system.

PLACE OF INDUCED INVESTMENT AND CONSUMPTION IN DYNAMICAL ANALYSIS

The temporal link is provided by making the variables of a system possess time-lags as explained above. The same temporal link is involved in *induced* behaviour of producers and consumers. The manner in which people behave at one moment of time is determined by the conditions prevailing at other moments of time. The past and the future—the experienced past and the anticipated future—both have their influence on the behaviour of producers

and consumers. This temporal link is clearly there in cases of induced investments and induced consumption. Induced investment is induced by what has happened or what is likely to happen in the future. It is not *autonomous*. It is endogenously determined and not exogenously dumped on the system.

We have in some of our models autonomous investment and autonomous consumption. These indicate no time-link between the various variables of our system They are exogenously given elements which affect but are not themselves affected by the components of our economy When and in so far as they are affected by the endogenous forces, they become endogenous themselves. Otherwise the time-link of dynamical (endogenous) system is provided only by induced behaviour of producers and consumers. In our previous equation, $E_t = {}_eY_{t-1}$, the expenditure is induced But we can have another relationship between expenditure and income such as

$$E_t = a + {}_eY_{t-1}$$

where a is the autonomous part of expenditure It has no time-subscript because it has not been determined by an endogenous entity Similarly, we can have induced and autonomous elements in investment In the equation

$$I_t = b + \imath\,(E_t - E_{t-1})$$

I_t is the investment in time t and is determined by b which is an autonomous element of investment and the increment of expenditure in period t over that in period $t-1$. The coefficient $\imath$ (which is called the accelerator) can be constant or itself a function of time.

The autonomous elements of consumption and investment are exogenous factors and, therefore, do not form a part of a truly endogenous (causal) dynamical system.

STATICAL ANALYSIS : THE BASIS FOR DYNAMICAL ANALYSIS

Let us now consider the relative importance of the two types of analysis. It is maintained that dynamics is the general type, static being a special (limiting) case of dynamics. Such a view gives an exalted position to dynamics. Whether it deserves that position can be ascertained only after we have examined the precise relationship between statics and dynamics.

It may be noted at the outset that where objective entities or subjective notions are constant, there is no difficulty in seeing them, in the one case, and understanding them, in the other. Absence of change is the pre-requisite condition for seeing and knowing When things and ideas are constantly in a state of flux, the physical eyes cannot see and the human mind cannot comprehend. It is the static element in any situation that makes it possible for us to understand and, therefore, to study it. But while there may thus be such a possibility, there is no necessity to study a static situation. When there are no problems, there is nothing to study. Since problems arise due to change, requiring looking ahead and making a search for the unexplored, a static situation offers no problem for solution, no situation for examination and study

The necessity for study arises when the dynamic element enters into the universe of our observation Problems then arise, darkness and uncertainty call for a careful search making it necessary to study the economic situation. A combination of the static and the dynamic makes it, thus, both necessary and possible to carry on investigations into the situation under our observation.

The importance of the static element stands out prominently here. If a (partly) dynamic system has to be studied, reliance has to be placed on the static technique , for, it is the static element that provides us the needed tools—it makes study possible. Since a static system is *timeless*, the basic tools of analysis must also be such as do not require the use of the changing time-element The analysis, if it is static, has reference to the present moment of time. But in a dynamical system there is the linking of the past (and the future) with the present. This link has to be so handled as to bring all the relevant elements of the situation into the present instant of time. Memory of the past and the expectation of the future help us to express all the relationships with reference to the same moment of time. The dynamic analysis is thus rendered static in form with the help of memory and anticipation.

Let us take the consumption and investment functions lagged as follows:

$$C_t = {}_eY_{t-1}$$
$$I_t = i\ (Y_t - Y_{t-1})$$

Consumption of time t is a certain proportion of income of period

$t-1$, i.e. income lags by a unit period of time. Investment is a proportion of the increment of income of period t over that of period $t-1$. If increment is taken into consideration there is no lag. We can make investment lag behind increment by substituting in the right-hand side of investment function $t-1$ for t, and $t-2$ for $t-1$.

To get a solution we equate Y_t to $C_t + I_t$. It will be seen, therefore, that in this equality there are no lags. The solution is sought through equalities of entities that belong to the same period or point of time. The equalities involved have reference to the same period of time because by the memory of the past and the anticipation of the future, past and future periods have been squeezed into the present. While consumption is related to past income, the relationship exists in the present. The memory of the past income is a present phenomenon. Investment is related to past rate of increase of income but the memory of the past exists in the present The static technique is again applied to the solution of the problem. The basic importance of statical analysis is revealed by the above examination of the technique adopted for the determination of income in the case of dynamic situations.

ENDOGENOUS AND EXOGENOUS VARIABLES

When variables vary a static system becomes dynamic. The variables may belong to a system as its constituent parts or they may be external to it. The former are called endogenous variables while the latter may be called exogenous ones. In the manner of their occurrence these variables differ but in the effect they produce on a system they are fundamentally alike. Once an exogenous force impinges itself on a system it becomes a part of that system and exposes itself to the reactions of endogenous forces. As observed earlier, an exogenous variable is an *unknown quantity* for the system. Their occurrence is not regular, or, at any rate, there is no knowledge of the principles that govern their occurrence.

An open economy, i.e. one that is open to exogenous influences, can be converted into a closed economy by extending the lines that *define* a system. But often it is a matter of convention as to what variables we regard as endogenous and what exogenous. The size and composition of a population and the technique of production (and also imports) are often treated as exogenous variables.

Changes in these factors are supposed to be autonomous rather than induced. Truly exogenous changes are no doubt autonomous for a system, but it is doubtful whether population and methods of production do not change as a response to developments that occur in the components of the system itself.

Population often grows in a fashion that cannot be attributed to changes in the variables of the system itself. But it is also true that it tends to grow in response to favourable economic conditions And such changes in population, of short duration though they might be, are induced changes and, therefore, endogenous in character. But changes in population that are in the reverse direction are clearly exogenous or at any rate appear to us as such. The same can be said of technology. That improvements in the technique of production are induced by endogenous forces cannot be doubted But that they are caused erratically by some unknown influences is also obvious enough. It is possible that when our knowledge of economic laws becomes more perfect many of the apparently exogenous variables will be found to be truly endogenous. But till then the dispute about what changes are endogenous and what exogenous is bound to continue.

CHAPTER 11

GROWTH MODELS: FUNDAMENTAL CONSIDERATION

KEYNESIAN AND POST-KEYNESIAN THEORIES

A VERY sharp distinction between the Keynesian and the post-Keynesian theories perhaps would not be justified. Knowledge grows by stages and one development gradually transforms itself into another New theories are born of the old and one can find the seeds of any new development in the soils of old ones Keynes was addressing himself to a baffling problem. There was unemployment, not merely technological and frictional, but quite a good deal of unemployment and the economy was yet apparently in equilibrium. There was something wrong with the famous Say's law of the market. Cheap money offered no solution. Keynes had to find the cause of the malady and suggest possible remedies.

There was under-employment of resources because effective demand was deficient. Low wages were no solution because in such situations low wages would further reduce effective demand. The remedy he suggested was in the main *fiscal.* The government should pump into the system fresh purchasing power by undertaking public works. Such a pumping in of purchasing power would create jobs, employment would increase and income grow, all through the operation of the multiplier.

His solution was simple and he was satified with it, it was not necessary for him to take account of other things that government investment can and would do. The consumption function, involving the multiplier coefficient, ensured increase of employment. The task to which he addressed himself was accomplished. But Keynes was not unaware of the other possibilities of autonomous investment. But the later economists began where Keynes had ended and carried his analysis to its remoter limits The post-Keynesian theory grew out of Keynesian ideas.

Keynesian preoccupation with the effect of investment on demand was understandable. Investment increases the purchasing power

of consumers and thereby their demand for (consumption) goods. This was what was wanted when Keynes proposed governmental investment. Savings reduce demand for consumption-goods and investment increases it Concentrating on these effects, Keynes built up a theory that has been labelled macro-static theory of employment and income Keynes' concern was with short-period tendencies and he offered a short-period solution—but a solution that could be extended to cover wider planning-periods. While, therefore, Keynes assumed that population and technical knowledge were the parameters of the system, his followers relaxed this assumption and turned these parameters into variables.

Investment, the post-Keynesians realised, not only increases the demand for consumption-goods, it increases the productive capacity of the system. Investment acts, in other words, both on the demand side and the supply side It increases the capacity of consumers to consume and the capacity of producers to produce. In this way a better, harmonious and balanced growth of the economy can be conceived. While Keynes drew our attention to the *multiplier* effect (Keynes was not the first to note this effect of investment), the later economists drew our attention to the effect of the *accelerator*. Investments increase consumption (*via* income) and consumption increases investment. With the multiplier and the accelerator acting and reacting on each other the inter-relationship between consumption as the end and production as the means gets strengthened. Our understanding of the relationship between the multiplier and the accelerator perfects our understanding of the behaviour of an economic system.

THE ACCELERATOR

When we come to the developments in the study of national income in the post-Keynesian period it becomes necessary to begin with the concept of the accelerator. Let us focus our attention on the basic relationship between production and consumption. Consumption is the end and production the means. When consumption increases more has to be produced to keep the balance and attain equilibrium. If and when production does not increase, prices rise and producers' profits get inflated. Let us remember that we are throughout using the word *profit* in the sense of surplus of income over cost. When profits increase the producers expand

production to more fully exploit the profit-potentialities. But capital is one of the factors of production There must be more capital if there has to be increased production. And capital-goods produce income little by little over a stretch of time. A capital-good, to take a simple example, of the value of Rs. 1000 would produce income worth more than that amount during a period of, say, ten years. If it produces every year an income of Rs 200 for ten years, we get altogether Rs. 2000 from the capital-good But since the annual income from the capital-good is Rs. 200, we can say that if producers want to produce an additional output (income) of Rs 200 they must have additional capital-goods of the value of Rs 1000. The capital-output ratio is here 5 . 1. When consumption increases by 1, investment in capital-goods has to increase by 5 Investment is accelerated. While the multiplier shows the multiplication of income (and therefore of consumption) caused by investment, the accelerator shows the acceleration (multiplication) of investment caused by consumption (and therefore by income)

It will be seen that in certain circumstances the accelerator is equal to the capital-output ratio This requires, first, that all investments in production are identified with capital-inputs and, second, that producers' calculations are correct and there is no speculation. In other words, the ex-ante investments should correspond to the required ex-post investments.

The accelerator shows the *action* (effect) of growth of consumption on investment and the multiplier shows the *reaction* of consumption to increased investment There is action and reaction between the two forces—the force of consumption and the force of production.

The accelerator has two influences acting on it There is the influence on it from the technical side and there is also the influence on it from the psychological side. If an investment of 1000 is technically required to produce an income of 200, the actual investment cannot deviate very much from this figure of 1000. But there is the producers' psychology that exerts some influence. The technical requirements operate on the system through the agency of the minds of the producers. That is why their optimism and pessimism and their established habits of thought interfere with the technical requirements of the system. But in the long run, if it is allowed to have its way, the technical influence must

prove the more decisive. In other words, the capital-output must provide the *norm* for the accelerator.

A MULTIPLIER-ACCELERATOR MODEL

Let us now express the consumption and investment functions so as to indicate the action of the multiplier and the accelerator.

$$C_t = cY_{t-1} \tag{1}$$
$$I_t = i(Y_t - Y_{t-1}) \tag{2}$$

Since to get the equilibrium condition we have to equate the receipt of the producer $(C_t + I_t)$ to the receipt of the factors (Y_{t-1}), we get

$$Y_{t-1} = cY_{t-1} + i(Y_t - Y_{t-1}) \tag{3}$$

It will be seen that we have equated the income of period $(t-1)$ with the expenditure of period (t). That is because equilibrium requires that the whole income should be spent (either on consumption-goods or on investment-goods) and income can be spent after it is earned, i.e. in the next period. Hence our equation (3) above equates the earnings of factors of production (income) in period $(t-1)$ to the earnings of producers or employers (expenditure of factors) in the next period—the only period in which it can be spent.

The equation (3) can be written as follows.

$$Y_{t-1}(1-c+i) = iY_t$$

Putting $t=1$, $Y_o\left(\frac{1-c+i}{i}\right) = Y_1$

Putting $t=2$, $Y_1\left(\frac{1-c+i}{i}\right) = Y_2$

or $$Y_o\left(\frac{1-c+i}{i}\right)^2 = Y_2$$

Hence, $$Y_t = Y_o\left(1 + \frac{1-c}{i}\right)^t$$

The income of any period (t) is therefore equal to the initial income (income of period 0) multiplied by $\{1 + (1-c)/i\}^t$. Here

c is the consumption coefficient (propensity to consume) and, therefore, the multiplier coefficient and i is the investment coefficient (propensity to invest) and, therefore, the accelerator coefficient. Naturally, c is less than 1 and i is greater than 1. It shows the ratio of additional investment to additional income. There is no lag here in investment as compared to increment of income But there is a gap on the consumption side Income lags behind consumption but increment of income does not lag behind investment.

It will be seen that in this simple multiplier-accelerator model consumption and investment are both induced There is no autonomous element in either consumption or investment. The economic system is purely endogenous.

Let us give some specific values to c and i, both of which are here assumed to be constant. Let $c=4/5$ and $i=3$. The expression for Y_t then becomes

$$Y_t = Y_0\left(1 + \frac{1}{15}\right)^t \qquad (4)$$

The income, therefore, increases continuously, becoming infinity at the end of time. As we said earlier, i is a psychological coefficient in the first instance but tends to equal the technological coefficient, i.e. the capital-output ratio.

GROWTH, LAGS AND EQUILIBRIUM

The above model shows that if equilibrium of the system has to be preserved there must be a continuous growth of income as indicated by equation (4). Equilibrium means here the equilibrium of the mind of the producers and not equilibrium necessarily in any objective sense. Income is not in equilibrium and so also not the factors on which income depends. The producers are, however, in equilibrium in the only sense (and the appropriate sense) that their expectations are realised. What they plan to produce they are able to produce and what they plan to sell they are able to sell off. The ex-ante and the ex-post entities are equal. We have, to ensure this condition, equalised the income dispersed by producers to the income received by them. This can be shown to be the same thing as the equality of savings ex-post and investment ex-post or as the equality of ex-post with ex-ante investment.

But the significant point to note here is that growth is consistent with equilibrium in this case, whereas in the cases previously considered by us stability was consistent with equilibrium Where income has stopped growing and has stabilised itself, the producers are in equilibrium with stable income because they expect the income to remain constant and this expectation is not belied by subsequent events. The ex-post turns out to be equal to the ex-ante

But in the above model income is known to increase and so the producers expect it to increase And when the rate at which the income actually increase turns out to be the rate at which it was expected to increase the producers are in equilibrium Their equilibrium is defined by the satisfaction they get from realised expectations Production in such circumstances proceeds smoothly.

But growth is a process that has time-dimension Income must grow over time. And this passage of time is represented and its significance for income variations shown in our model through the device of time-lags. Income is earned in one period and spent or disposed of in the subsequent period. This fact brings the movement of time into the picture Time now begins to matter. In the static models that we took up in the preceding chapters, time was not moving, as it were. That is because the economic entities that realise themselves in time did not change. And when they do not change, time loses its identity Time appears to have stopped moving We cannot have any idea of time-changes except through the changes of the entities that have location in time.

In the present model time appears to move and change because the entity that has location in time is changing. This changing entity in this case is income. Hidden behind this entity are others that our model does not make explicit. But income is the resultant of productive efforts and there are, therefore, factors of production behind income These are changing in such wise as to make income grow continuously according to equation (4). There must be a continuously increased application of factors of production to ensure a continuously increasing income-generation. As we explained earlier, it is not necessary that all the factors of production must increase or that they must increase in the same proportion. The coefficients of production are elastic to an extent, we can produce more income without having to increase all the factors at the same time.

GROWTH: ENDOGENOUS OR EXOGENOUS?

Our model is purely endogenous. There are induced consumption and induced investment and, as we explained earlier, when all changes are induced (from within the system) there is no exogenous influence. The economy becomes a *closed* system. The forces that account for change operate from within, in the above model, and keep on operating Since the income grows continuously the endogenous factors are also continuously gathering force. Can such a process of growth of factors continue *ad infinitum*? If they cannot, income would stop increasing ultimately and the equilibrium of the system (of the mind of producers) would be disturbed. In such a case we can say that internal forces, by acting and reacting on one another, have exhausted themselves

The model, as depicted by the above equations, does not guarantee either that income would increase continuously or that it would not It only shows the relationships existing between certain broad variables of the system And the mathematics applied to those equations reveals the fact that, unless some new forces are generated which are not explicit in the system of equations, equilibrium would prevail if income grew at the rate shown by equation (4). This is a very non-committal conclusion. It is very necessary that we know this fact. For, it would guard us against drawing conclusions which are not warranted by the facts of the case. The equations, we repeat, do not show that income will continue to grow. It only shows that if no other forces impinge themselves on the system (whether generated from within or introduced from outside), the attempt of producers to preserve their equilibrium would result in a continuous growth of income as given by the equation (4).

But most likely the system would generate some counteracting forces from within itself The ceilings and floor, and other frictions provided by the difficulty of increasing certain factors of production, constitute such counteracting forces. And because of such forces the original forces propelling the system get exhausted. Growth then comes to a stop. Hence, it appears that for sustained growth a system has to depend on some exogenous stimulus. If we take the whole world as our macro-economy and thus rule out the possibility of external forces emanating from other regions, continuous growth of income can only be accounted for by forces from the supra-earth regions.

CHAPTER 12

HARROD'S MODEL

HARROD'S AND HARRODIAN MODELS

THE MODEL constructed by Harrod is *Harrod's model*. If we retain its characteristic features and make in it certain alterations that conform to those characteristics we get what we might call Harrodian models We have Keynes' economic theory and Keynesian economic theory, similarly we can have Harrodian model, Hicksian model, and so on That which is the peculiar feature of Harrod's model must be retained in all the models that are Harrodian The differences between the models built by the various economists are not always very radical or pronounced In fact, one does not know which of the features of a particular economist's model should be regarded as the peculiar characteristics of that model For instance, there may be a time-lag of one period in income behind expenditure in one model while there may be a two-period time-lag in another model Whether that should be taken to make a radical difference to the features of the two models is not clear. In one sense, the difference is not radical, in another, it is For, income-generation is different in the two cases. However, we need not dilate on this point Let us take up Harrod's model first.

HARROD'S SIMPLE MODEL

Assumptions are the raw materials with which we build our theory. To construct a model we have to make assumptions in regard to the behaviour of those who are responsible for the generation of income. We know that real income is produced by producers but since production is a means to consumption this real income is ultimately governed by the wants and demands of consumers. We have, therefore, two sets of people who are responsible for the production of income, *viz.* producers and consumers, and so we have to make some assumptions in regard to their behaviour. Harrod makes the following assumptions.

He assumes that income-spenders spend a certain fixed propor-

tion of their income and, therefore, save also a fixed proportion of it. The saving of a period bears a constant relation to the income of that period. The constancy of this relation is a simplifying assumption which is allowed to relax itself at a later stage. Here in this assumption in regard to the behaviour of income-spenders, Harrod does not introduce a time-lag, income does not lag behind consumption or saving. Since *action* is preceded by *intention*, this constant proportion of income that is saved is the intended amount. But Harrod supposes that when a man has made up his mind to save, say, one-fifth of his income, he does actually save that amount. If he has to alter his ways of living he will alter them in order to be able to stick to his decision. In other words, Harrod's assumption is that actual and intended savings are the same If income is constant, it means as we said earlier, that actual and intended consumption will also be equal. Ex-ante and ex-post savings are taken to be equal so that if income is not constant or not according to expectations, the ex-post consumption and ex-ante consumption will be different.

Next, Harrod makes an assumption in regard to the behaviour of producers. The producers' intentions must precede their action. So Harrod makes an assumption in regard to the intention of producers. The producers invest a fixed proportion of the increase of income If income increases in a given period by an amount $\triangle Y$ over that in the preceding period, the producers will intend or plan to invest a certain multiple of $\triangle Y$ in that given period. This assumption is in a rough way realistic which means that there is nothing in this assumption that is completely ruled out by our knowledge of the behaviour of producers.

Here also Harrod does not introduce any time-lag; investment is based on the increase of income of the same period (over that of the immediately preceding period). Now, it will be noticed that Harrod gives us two equations, one showing the behaviour of consumers (income-spenders) and the other showing the behaviour of producers (income-creators) If we want to find out the manner in which the economy behaves we should postulate equilibrium of the productive machinery. The producers must be in equilibrium; unless they are, we cannot get any idea of the manner in which income or the other variables of the system would behave. If we have to *determine* the path of income we have to postulate equilibrium. Nothing that is not in equilibrium can be *determined.*

Hence Harrod next supposes that producers which means investors are in equilibrium But they are in equilibrium only when their plans are realised, i e when events turn out as expected Their planned or intended investment must be realised the actual or ex-post investment should just equal the intended, planned ex-ante investment If these are not equal there is disappointment on the part of producers and things will not proceed smoothly they will not proceed in any predictable or determinable fashion Hence all that we can do is to attempt to find out the determinable, predictable fashion of movement of income For that purpose we assume equilibrium of the productive system, i e equality of ex-post and ex-ante investments

Savings we have already seen, are equal in the ex-post and ex-ante *senses* That is by virtue of the assumption that Harrod makes—an assumption which may or may not be quite true to life but which is nevertheless not absurd And further ex-post saving is the same thing as ex-post investment What a man actually saves is his investment because it is not his consumption And as we know there are only two kinds or categories of goods *viz* consumer-goods and capital-goods The former are those which account for consumption of income, the latter those which account for investment of income According to this way of looking at things all unsold goods and, of course, unspent money become investment And that is quite correct from the logical point of view

Hence to equate ex-post to ex-ante investment we have to equate savings to ex-ante investment Now let us put down the behaviouristic equations as follows

$$S_t = sY_t$$

and

$$I_t = g\{Y_t - Y_{t-1}\} \qquad 2$$

Postulating equilibrium we get,

$$sY_t = g\{Y_t - Y_{t-1}\}$$

or

$$\frac{s}{g} = \frac{Y_t - Y_{t-1}}{Y_t} \qquad 3$$

Recall that s and g are constants That makes the left-hand side of the equation (3) constant, and therefore, the right-hand side must also be constant But the right-hand side shows the increase of income of period (t) over that of period $(t-1$ as a

proportion of income of period (t) In a way it shows, therefore, the rate of increase of income which, according to this equation, is constant. The conclusion is that when producers are in equilibrium—when the productive system is in equilibrium—income must increase at a constant rate And reversing this statement we can say that income should grow at a constant rate in order to keep the system in equilibrium. When the rate of increase of an increasing income is constant the increments of income (the absolute amounts added to income) are increasing. The system will be in equilibrium, in other words, if greater and greater additions are made to income.

Harrod can be regarded as a pioneer in growth models He begins by assuming that income is growing and, therefore, he makes investment a function of the increase of income. In this model we start at some point at which income is greater than what it was in the preceding period. That is the only assumption one need make. Once that is so, the condition and necessity of equilibrium requires that the rate of increase must be maintained The economy can behave in any other erratic way—income may increase at different rates at different times—but in that case, as we have already observed, no *determination* is possible, no definite statement can be made. Here we are theorising; we simply say that if income increases in such and such a fashion, there would be smooth sailing Has such a statement any practical significance? Is it of any use to know that if income was to increase in such and such a way there would be equilibrium?

The answer is in the affirmative with certain reservations. There is always a tendency in Nature and in human affairs towards equilibrium. Disequilibrium produces forces that check disequilibrium. And if that is so, we can say that inherent in an economic system there is a tendency towards a constant rate of increase of income when the initial conditions are such as to set the ball rolling, i.e. to increase income. But this we can say with some reservation. In some cases disequilibrium situation produces forces that instead of checking disequilibrium give further stimulus to it. In addition to such behaviour of a system there may be some exogenous forces the influence of which may also be to aggravate the trouble by encouraging the forces that cause disequilibrium.

But there is some reason to suppose that the tendency towards

equilibrium is in the long run stronger than the tendency towards disequilibrium. Nature seeks harmony and the battle of forces must come to a peaceful solution. Harrod's model has, therefore, an importance which is not confined to theory only.

But we have just observed that it is possible at times for disequilibrium to perpetuate itself Let us see how that happens when it does happen.

Suppose, as Harrod says, income at a certain moment of time is not increasing at the rate at which it should in order to keep the system in equilibrium Why it does not increase at that rate should not bother us Our economies are subject to so many unpredictable forces If Nature makes no mistakes, at least we make mistakes in the intentions of Nature. Moreover, we may make mistakes in knowing, or anticipating the minds of other people, and at times we are not clear about our own mind The conscious and the subconscious may not be in harmony But let us not bother about that, we know that income may or may not always increase according to equation (3) above.

Suppose income increases at a smaller rate than is consistent with the equilibrium of the system, i e. let income increase less rapidly than at the warranted rate In terms of the above equation then

$$Yt - Y(t-1) = \frac{s}{g} Y(t) - c$$

where c is some positive constant. The left-hand side of the above equation is the increase of income in period (t), which is less than before by the amount c We can rewrite it as follows

$$sY(t) = g\{Y(t) - Y(t-1)\} - cg$$

The left-hand side of this equation is actual ex-post investment while the first part of the right-hand side is intended investment. The expectations of the producers are not realised. They, therefore, encounter a state of over-investment which is the same thing as over-production. Now, when producers find that stocks are accumulating they cut down their investment which has the effect of reducing the income of the people National income, therefore, falls further. The value of c in the above equation rises The gap between ex-post and ex-ante investment widens and the state of over-production gets accentuated. This shows that if due to some reason income does not increase at the equilibrium rate (which Harrod calls the warranted rate) but at a rate lower than that.

forces are generated which cause a further reduction of income. This progressive fall of income is the unsuccessful attempt on the part of the system to reach a position of equilibrium.

One can show in the same way that if due to some reason income happens to increase at a faster rate than the warranted, under-investment results, production appears to be in short supply and investments increase This causes a further rise in the increase of income and the state of under-investment or under-production is accentuated The equilibrium is unstable Forces generated by a deviation from the warranted rate of growth of income do not tend to bring the system back to the position of equilibrium.

CYCLES IN THE GROWTH MODEL

Should the above model of Harrod be called a growth model or a cycle model? The above model, let it be noted, does not tell us why income *starts* increasing; it tells us why income, if it has begun to increase, continues to increase. The cause of its start may be endogenous or exogenous and it is a matter for the historian to enquire into As economists we take the increase of income as a (historical) datum and then determine the conditions necessary for its continued existence. The condition rests on the necessity of equilibrium. The condition necessary for its continued existence is found to be a certain rate of growth which is called *warranted rate of growth.* In this sense, Harrod's model is a growth model. It combines growth (a dynamic phenomenon) with equilibrium (which is fundamentally a static concept) But the same model can be turned into a model of (cyclical) fluctuations Again, Harrod does not say why the warranted rate of growth is upset. That is also a given datum for the economist. But once a deviation takes place, Harrod shows how that disequilibrium can get worse and worse. If income rises slowly, a downward turn is given to the rate of increase. If income begins to rise more rapidly, an upward turn is given to the rate of increase.

Harrod's model can, therefore, show fluctuations also. And this consideration supports what we have said earlier, namely, that basically growth, decline, and fluctuations are different phases of the same process. Fluctuations are disappointed growth-tendencies or disappointed decline-tendencies. But it remains to see how once a cumulative process of over-production or under-production

starts, the direction of income movement is changed We must show how when income starts increasing more rapidly than at the warranted rate, it comes to a halt and then takes a turn To show this, we shall use the Hicksian barriers provided by ceilings and floors about which we have already said something

THE CEILING AND THE FLOOR IN THE GROWTH MODEL

We know that if income has begun to increase it should continue to increase at Harrod's warranted rate if the system has to be in equilibrium We also know that such an equilibrium is of a dynamic type because in spite of the equilibrium of producers' mind income (the *end* of production) continues to be a variable quantity And we know further that if for some reason this equilibrium is disturbed by a change in the rate of growth of income, the disequilibrium would continue to gather force The income would keep on decreasing or increasing. All this let us remember is based on the assumptions about the behaviour of producers and consumers that Harrod has made

It should, therefore, be clear that if we allow for disturbances to the system income would grow with ups and downs There are on the one hand, the forces that tend to push the income up continuously and, on the other there are disturbing forces that (in conjunction with the psychology of the people) retard this push sometimes and stimulate it at others. Fluctuations, therefore are superimposed on a rising trend of income

However, for these *ups* to turn into *downs* or the *downs* to turn into *ups*, there must be some counteracting terminal forces These we might following Hicks call ceilings and floors of which we have already spoken in the preceding chapter. To remind ourselves the ceiling is provided by the scarcity of productive factors and, therefore, by the maximum limit to investment while the floor is provided by the maximum limit to disinvestment.

We saw further in the preceding chapter that some erratic shocks to the system can also reverse the direction of change of income The shocks have no regularity of occurrence They can be truly exogenous. Exogenous forces are historical events in the sense that we find them having a location in time but we do not know how they have chosen their temporal location. The ceilings and

floors are endogenous in nature as they spring from the forces that the system itself generates.

CHANGES IN PRODUCERS' AND CONSUMERS' BEHAVIOUR

Harrod assumes for the sake of simplicity that the savings-coefficient s and the investment coefficient g are invariant with income. That is, he assumes that income-spenders continue to save a fixed proportion of their income and income-producers continue to invest a certain multiple of increase of income, no matter whether the income is high or low or its rate of change is rapid or slow. But later Harrod relaxes these assumptions or rather their rigidity, and considers what would happen if these coefficients were allowed to be influenced by what is happening in the economic system

When the rate of increase of income falls and the state of over-production prevails, the value of investment coefficient g becomes smaller. Since in such cases actual investment is in excess of intended investment, producers become pessimistic and decrease the rate of fresh investment. For, with some past investment unused there is less need of fresh investment and this is further reduced due to a change in expectations entertained by producers. Our conclusion that, when income increases at a rate slower than the warranted rate, forces are generated to decrease the income still further now gets strengthened.

But during such a phase of a dynamic economy the value of savings-coefficient also falls and s becomes smaller. That is because with reduced purchasing power people find it hard to save just the same proportion of income as before. Though with falling prices the value of money rises and thus makes it a little more advantageous for people to postpone consumption, the overall effect is in the direction of reduction of the value of s. With a smaller value of s the above conclusion loses some of its force. Less saving means more consumption so that when s decreases a larger part of income is spent on consumption-goods. The multiplier effect is strengthened. And that has its own influence on the accelerator coefficient; it arrests the fall in the value of g caused by the state of over-production.

Thus the two influences work in opposite direction but, on the whole, changes in the values of the two coefficients tend to aggravate the situation. The fall in the value of g is only partly arrested by the rise in the value of s.

THE BATTLE OF PSYCHOLOGICAL AND PHYSICAL RATES OF GROWTH

Harrod's warranted rate of growth may be called *psychological rate of growth.* For, it is the rate which the psychological reactions of producers and consumers (savers) to income variations tend to bring about It is the equilibrium rate of increase of income in the sense that the human mind, with its given reactions to changing environments, tries to bring about that rate in order to maintain its tranquillity It is a norm of growth-rate for the psychology of producers whose behaviour is governed, along with other things, by the behaviour of income-spenders

But the physical side of an economy exercises its own influence on the production of income Here it is the case of human psychology *proposing* and physical conditions of Nature *disposing.* Harrod rightly says that physical forces interfere with the warranted rate of growth of income. If growth has to be maintained factors of production must increase The available quantities of factors should be more and more fully utilised or their productive capacity continuously increased Nature might come to the rescue of an economy by allowing population to increase There is no other direct way in which Nature helps an economy. Improvement of technology is partly a natural phenomenon but it is included in the growth of population. For, technological advance is determined by human beings.

But the human mind with its wishes and desires cannot run away with an economy. The growth of factors of production (which is a good deal under the control of Nature) exercises a check on the fulfilment of our desires The man-desired warranted rate of growth has to fight a battle with the Nature-controlled physical rate of growth. Harrod calls this rate of growth *natural rate*

Nature provides material resources for man's use These resources determine, in their own way, the potentialities of growth. But by themselves these Nature-given factors are as powerless as man himself is without Nature's help. Their cooperation with each other is needed for purposes of production. But while Nature helps man to satisfy his wants, it also offers him some resistance. While it places obstacles in man's way, it also has very much to offer him, but man has nothing to offer in return. The battle between the physical and the psychological forces is waged with varying fortunes.

This philosophy aside, Harrod speaks of natural rate and so do some others. But the above relationship between the two rates shows that there is very little practical as also theoretical significance in the concepts of warranted and natural rates of growth The two rates depend on each other in such a way as to make it difficult to conceive of one in complete isolation of the other

The one way in which we can conceive of warranted rate is to suppose that Nature offers unstinted cooperation to man In such a case, the psychology of producers would meet with opposition and the increase of income at the warranted rate would be maintained But such unstinted cooperation from Nature is not imaginable. To imagine that is to forget the basic facts about production. However, if we could ignore Nature's wrath on the one hand, and human greed, on the other, we can think of the two rates of growth as having separate existence.

But the battle royal goes on between the psychological and the physical rates and their outcome is what is called the *actual rate* It is, as it were, a compromise between the two rates—a peace treaty between the warring parties. While the warranted rate of growth is the ex-ante rate for the producers, the natural rate is the ex-ante rate for the economic theorist and the actual rate is the ex-post rate both for the producers and the economists The consumers are the passive spectators of what happens although their influence in determining these rates is there all the same.

CHAPTER 13

HARRODIAN MODELS

FEATURES OF HARROD'S MODEL

HARROD'S MODEL shares with other models two features which have structural importance. Harrod takes producers' and consumers' (savers') behaviour as the moving force behind the moving economy. Between them these two categories of people must exhaust the entire animate system. The economic system is what these two forces working within the framework provided by institutional factors make it.

While these features in their broad outline must be possessed by all models there are others that are peculiar to Harrod's model. But the important constituents of a model are so limited that even the peculiar features of a model find their counterpart in other models.

What are the significant elements in Harrod's model? There are the two behaviour equations. In one, savings are a '*fixed* proportion of *current* income in the other investment is a '*fixed*' multiple of *present* increment of income. The italicised words are significant. The word "fixed' is bracketed as Harrod relaxes this assumption of fixity of coefficients to make some modification in his conclusions. But the behaviour of producers and savers shows no lags. We had an occasion to observe that the smaller the period the greater is the necessity of introducing lags in the models. Harrod does away with lags by implicitly making the period long enough to minimise the necessity of time-lags. The other feature to which attention might be drawn here is the purely endogenous nature of the model. Let us remember that by Harrod's model we mean the simple model with which Harrod starts his analysis so that what we call Harrodian models will at times overlap with Harrod's model in its unsimplified form. Investments are induced, though the possibility of autonomous investment is considered. Again, the simple model ignores the influence of other variables of the system on the behaviour of producers and consumers. These other variables are capital-stock (the stock concept of investment), imports, etc.

VARIATION OF TIME ANALYSIS

Production proceeds by stages and so naturally the analysis of income-generation runs in terms of periods. Income of one period is greater than that of another. We can reduce the size of the period so that instead of passing from one period to another with a jerk we can pass on smoothly. This is, in mathematical language, the distinction of period analysis and continuous analysis. Instead of $Y(t)-Y(t-1)$ which is a lumpy and jerky increment of income, we can have dy/dt which shows the rate of growth over time. In calculus it stands for continuous or infinite variation. If we make this substitution in Harrod's simplified model what difference would it make to the economic significance of the model?

dy/dt means the increase in income caused by a very small variation of time. It shows, therefore, the increment of income secured in time (t) over that of time $(t-1)$ where the unit of time is very small. We call it the rate at which income is increasing. If the unit in which we measure time becomes very small, the mathematical significance of the notation is well preserved but its economic applicability becomes unnatural. For, income cannot increase during a very small time interval. But the formal applicability of the mathematical calculus still remains intact. With this reservation let us proceed to introduce this variation in Harrod's model.

As before $S = sY$

but now $I = g\,(dy/dt)$

It will be seen that we have no time suffix after S or after I because time now is taken to vary continuously. To find the value of income over time consistent with equilibrium conditions we equate, as before, savings (intended) with investment (also intended), and get

$$s.Y = g.(dy/dt)$$

or

$$(dy/dt)\times(1/Y) = s/g$$

This equation is in terms of rate of increase of income. To render it in terms of amount of income, we can *integrate* it with respect to time (integration means summation) and get

$$\log Y = \frac{s}{g}t + a \text{ constant}$$

because the differential of $\log Y$ with respect to t is $(dy/dt)\times(1/Y)$.

We can eliminate the logarithmic expression and get

$$Y = Y_0 e^{\frac{s}{g}t}$$

Here if we put $t = 0$, Y becomes equal to Y_0. Hence Y_0 represents initial income e here is the logarithmic base.

It can be easily seen from the above expression for income (Y) that as t increases, that is, as time passes, income progressively increases. The only condition required is that s/g should be positive. And the behaviour of producers and savers is such as to make these co-efficients positive.

Here also it must be remembered that while the mathematics and the psychology of the producers and consumers make continuous increase of income a possibility, there are natural elements in the system that prevent such a limitless increase All this has already been discussed and so we need not dilate on the point here. The equation has a formal validity from economic point of view. It only tells us that if income was to increase in this fashion the producers would be so satisfied that they would not do anything to interfere with it.

VARIATION OF PRODUCERS' BEHAVIOUR

It has been assumed that producers react to the behaviour of income. They change their production plans when income changes. This change of their plan results in further change in the behaviour of income. An increase of income causes further increase of income but through, and naturally through, increase of factors of production Capital-goods constitute an important element in this increase. Investment so far considered is a *flow* concept—investment flows into the system over time. But this flow *consolidates* itself into capital-equipments. Investment, that keeps track of income, produces a *stock* of investment which must have its own influence on investment decisions of producers. The *solidified flow* that produces capital-stock must exert its influence on investment.

It is possible, however, to over-emphasise the influence of capital-stock on the behaviour of producers. If capital-stock is a natural and necessary result of investment, it should have no independent influence on fresh investment. Its influence must be felt through income. However, if capital-stock is not a natural

and necessary result of investment, in the sense that it is the result of miscalculations resulting in faulty adjustments on the part of producers, it can exert its influence directly on fresh investments.

Let us, following the usual notation, represent capital-stock by K.

Then, as before $S(t) = sY(t)$

But now $I(t) = g\{Y(t)-Y(t-1)\}+g'K_{t-1}$

Equilibrium condition is given by $S(t) = I(t)$

or $$sY(t) = g[Y(t)-Y(t-1)]+g'K_{t-1} \quad (1)$$

or $$\frac{s}{g} = \left[\frac{Y(t)-Y(t-1)}{Y(t)}\right]+\frac{g'}{g}\cdot\frac{K_{t-1}}{Y(t)} \quad (2)$$

Here we can let s, g and g' remain constant K_{t-1} is the stock of capital in period $t-1$. That shows that the addition to investment in any period is a fixed multiple (g') of the stock of capital that already exists. And the stock that already exists (before investments are made in the current period) is the stock of the previous period. If we allow ourselves to make a slight, perhaps not justified, change and put the capital-induced investment equal to $g'.K_t$, then the equation (2) above would show that the rate of increase of income in period (t) is equal to

$$\frac{s}{g}-\frac{g'}{g}\times\frac{K_t}{Y(t)}$$

Hence, the rate of increase of income is less than what it is when investment is only income-induced by the amount $\frac{g'}{g}\times\frac{K_t}{Y(t)}$. Since $K_t/Y(t)$ is the ratio of stock of capital to income capital output ratio), the rate of increase of income slows down by g'/g times the capital-output ratio.

It may be mentioned here that

$$K_t = K_o + \int_{t=0}^{t=t} Idt.$$

For, the capital-stock is equal to the initial stock (at time zero) plus the income induced investment made period after period during the time interval $t = 0$ to $t = t$.

We can substitute this value of K_t in equation (1) above and determine the path of income Y over time but it is a complicated process. It is sufficient to note that when capital-stock also in-

fluences the decision of producers to invest, the rate of increase of income that is necessary to keep the producers in equilibrium is slower

We can find a parallel to this phenomenon in the behaviour of an individual He who looks only to his income will need greater additions to it to satisfy his greed But he who also derives some satisfaction from his capital (accumulated wealth) will not need equally large additions to his income

But as we observed above, capital accumulation will begin to influence producers' decisions only when, due to maladjustments in the system, more investments or less investments than necessary have been made in the past, or when the psychology of producers makes them feel that way.

A word may be said here about the sign g', the coefficient of capital-stock. When income is increasing there is, in general, a feeling of optimism prevailing among the producers. The growing stock of capital in the economy, therefore, does not act as a check on the rate of fresh investment Rather, since we have assumed that capital-stock influences producers' decisions, it stimulates investment. And that being so, g' is a positive number when income is growing, and growing at the warranted rate But when income is decreasing or its rate of growth is below the equilibrium rate, producers become pessimistic: and it is then that the size of capital-stock begins to exercise a damping influence on current investments

During depressions, therefore, g' has a negative sign The conclusion that when investment is allowed to be influenced by capital-stock the equilibrium rate of growth of income is slowed down does not hold during times of depression. It may, however, be that all this can be subsumed by the consideration of changing values of g during the different phases of the trade cycle.

VARIATION OF CONSUMERS' BEHAVIOUR

In the models considered so far, consumers' behaviour was taken to be determined by their current income Now let us see how income would behave if consumers were to take their past savings into account while determining the amount to be saved in any particular period. We can assume, as we did in the case of producers, that when income is increasing (at least when it is increas-

ing at the warranted rate) there is no pessimism to damp the enthusiasm of savers and consequently that the influence of past savings is to increase the proportion of income saved. We then have the following equations defining the behaviour of producers and consumers.

$$I(t) = g\{Y(t)-Y(t-1)\}$$
$$S(t) = sY(t)+s'K_{t-1}$$

These can be solved to give us the expression for rate of growth of income which is,

$$\frac{s}{g}+\frac{s'}{g}\times\frac{K_{t-1}}{Y_t}=\frac{Y(t)-Y(t-1)}{Y(t)}$$

It will be seen from this equation that since the second part of the left-hand side of the equation is positive, the rate of growth of income is greater than what it would be if past savings had no influence on current savings. This effect of past savings on the generation of income stream is, therefore, the reverse of the effect of past (realised) investment. Equilibrium requires a faster rate of increase of income when savings are sensitive to accumulated wealth than when investment is sensitive to capital-stock. In other words, producers are satisfied only when income is increasing more rapidly to counteract the effect of increased savings by the people.

Here too we can say that the conclusion would need to be reversed during the depression phase of a cycle. Further, we may argue as before that if we substitute K_t for K_{t-1} we can couch our conclusions in terms of capital-output ratio.

It will be seen from the equations that past-savings are put equal to capital-stock. That is because past (realised) savings are (in equilibrium) equal to past realised investments, i.e. the capital-stock.

AN OPEN SYSTEM

Let us now open out our system to exogenous influences emanating from a foreign system. We shall limit such influences to those that figure themselves out in the shape of imports and exports. Our own system becomes now only a part, though a very major part, of the network of interacting forces. The process of income generation is now determined by extra-system variables.

We shall suppose that people save a certain part of their income for expenditure within the country and another part for expenditure outside the country, i.e. for import of goods And we shall suppose that producers invest a certain amount for export of goods This amount does not depend on the income of our (now open) system. It depends, immediately, on the income of the foreign system and, in a remote way, on our own income We shall, therefore, assume that the amount invested in the production of goods for export is invariant with our income and, in the absence of the knowledge of any other relationship, invariant with all other variables In other words, we take it to be a fixed amount of the nature of a fixed autonomous investment.

Our behaviour equations can, then, be put down as follows:

$$S(t) = sY(t)+iY(t)$$
$$I(t) = g\{Y(t)-Y(t-1)\}+e$$

For equilibrium, as defined earlier,

$$sY(t)+iY(t) = g\{Y(t)-Y(t-1)\}+e$$

or

$$\frac{s+i}{g}-\frac{e}{gY(t)} = \frac{Y(t)-Y(t-1)}{Y(t)}$$

The first part of the left-hand side of the equation is constant and greater than its counterpart in the simple model. The second part has a negative sign and is a decreasing function of time during a period of rising incomes. On rewriting the above equation as

$$\frac{s}{g}+\frac{igY(t)-eg}{g^2Y(t)} = \frac{Y(t)-Y(t-1)}{Y(t)}$$

it can be seen that in this type of open system the rate of growth of income will be greater or smaller than that in a simple closed system according as $\frac{igY(t)-eg}{g^2Y(t)}$ is positive or negative, or, as can be seen easily, according as $iY(t)$ is greater or less than e; which means it depends on whether imports are greater or less than exports.

This conclusion must be carefully understood. One should not jump to the conclusion that when imports are in excess of exports the country will be in a more prosperous state as its income would rise faster. The mathematics of this open system tells us only this: that if a system imports more than it exports, in terms of its own unit of measurement of income, the producers would not be in equilibrium unless the rate of growth of income

was accelerated The home economy would have, in other words, to push up its production to accommodate (fill) the gap created by foreign trade deficit.

We must be very careful when we handle the tools of mathematics. Mathematics is said to be the logic of numbers and so it certainly is But the logic of words is often easier to understand than the logic of numbers. The latter makes a greater demand on our vigilance. But when that demand is satisfied, clarity is the result For, one can be vague with words but one cannot take that liberty with numbers.

We have finished our study of some Harrodian models As we remarked earlier such models must lie on a disputed border-line as they can incorporate features of two or more different models

CHAPTER 14

THE ACCELERATOR

NATURE AND IMPORTANCE OF THE ACCELERATOR

THE MODELS considered in the last two chapters were based on the multiplier and the accelerator. The former has relation to consumption coefficient, the latter to investment coefficient. These two coefficients act and react on each other. But as we saw earlier their effectiveness is limited by certain factors, the most important of which for our purpose was found to be the maximum limit to the increase of factors of production.

Let us say a few words about the nature and importance of the accelerator. The accelerator, as it figures in our equation for investment, is psychological in its origin and contents. A certain increase in income (or consumption) calls for an accelerated increase of investment. This accelerated increase is desired, planned and intended by producers. But there is always a basis for producers' plans, they desire a certain investment because they think that the technological factors make such an investment necessary. The physical and the psychological requirements, as it were, might not always be at par; but they cannot be persistently different from each other. That is why, as we said before, the accelerator must in the ultimate analysis be determined by and become equal to capital-output ratio. But this tendency encounters strong opposition now and then due to which perhaps at no time is the capital-output ratio able to exert its full influence on the accelerator. Further, the capital-output ratio for the whole economy is a troublesome ratio for the theorist. We are couching our analysis in macro-terms while the decisions in regard to investment are made by micro-units. And the capital-output ratio also operates through micro-units. This difficulty the problem in hand shares with all other problems in macro-economics.

It is sometimes believed that there is no statistical evidence for the accelerator of the kind we use in our models. Long ago Professor Tinbergen investigated into this problem and came to the conclusion that the behaviour of investors revealed no accelerating

effect of increased consumption or income. One must be very cautious in accepting the findings of empirical investigations Such investigations cannot take account of all the factors that need to be taken account of. Inductive analysis must always be supported and tested by deductive reasoning The former relies more on our senses than the latter. Whether there is empirical evidence for the accelerator or not, we as economists cannot shut our eyes to those subtle forces that operate behind the curtain. One cannot produce consumption-goods without capital-goods, and capital-goods cost more than the consumption-goods they produce year by year. The value of capital-goods is, as we very well know, the capitalised value of the goods they (are expected to) produce during their lifetime. The accelerator must, therefore, operate unless there is unused excess capacity.

There would be no accelerator-effect in an economy that used no capital-goods. But that is hardly imaginable. The more capitalised the method of production, the greater must be the value of the accelerator The significance of the accelerator is dependent on availability of real resources as against money supply. When income and consequently consumption increase, production has to increase in response to it. Resources have to be engaged in the production of capital-goods needed for the purpose. The resources needed are not in proportion to the consumption-goods demanded and that causes the accelerator to operate The basic fact that production of capital-goods necessitates postponement of consumption is at the root of the problem. More work and (temporarily) less consumption is responsible for the acceleration of derived demand. Was more work (than what is necessary for immediate consumption) not needed, the accelerator would not have operated

When resources are fully employed the accelerator (in real terms) ceases to operate. That is because when there are no idle resources we cannot have the phenomenon of "work more than consumption"; if people are engaged in the production of capital-goods and consequently work increases, there must be an equal number unemployed in (shifted from) other activities. Thus, work on the whole does not increase; the accelerator does not operate.

CONSTANT AND VARIABLE ACCELERATOR

In the previous models the accelerator was taken to be constant;

which means we supposed that irrespective of the size of income or increase of income, the accelerator coefficient was the same. Whether the increase of income is 100 or 1000, producers invest the same proportion of the increase. This may or may not be a correct assumption to make, but it greatly simplifies the solution of our problem

There are model builders who have used non-linear accelerators such as Hicks and Goodwin. Such accelerators complicate the mathematics of the problem though they introduce, perhaps, some desirable elements into the models making them more realistic. Let us diagrammatically illustrate the effect of the accelerator on the growth of income.

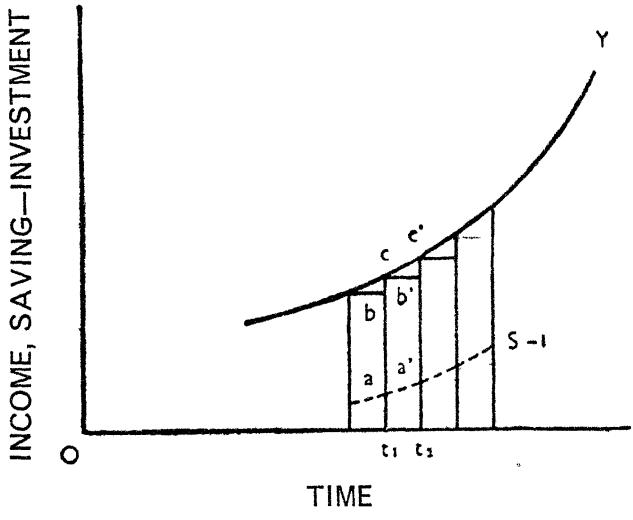

FIG. 7

The diagram above measures time on the X-axis and income, savings and investment on the Y-axis. The curve Y shows the growth of income over time while the dotted $S—I$ curve shows savings and investment which are equal in the equilibrium (warranted) growth of income. Since the savings function shows that savings are a constant fraction of income (here in the diagram about 1/3) and investment is a constant multiple of increase of income (here in the diagram about 3), at_1 is one third of ct_1 as also three times cb. The relationship will hold at all other points on the curve.

The vertical distance between the two curves at the point t_1 on the X-axis shows consumption during the period t_1. The same is true of vertical distances at other points From the property of a convex curve it can be seen that increasing additions are made to income as income grows overtime. That is the condition that ensures equilibrium growth of income.

Now let the investment function be non-linear, i.e. the coefficient g varies with some entity of economic signficance. It is most reasonable to suppose that it varies directly with income which means that it increases as income increases. In that case the growth of income will slow down. This can be seen from the diagram in the following way.

If the value of g increases as we proceed along the axis of X the distances at_1, $a't_2$ .will be more than three times as big as the distances cb $c'b'$.... To enable them to be so and yet let them be one-third of ct_1, $c't_2$...the Y curve must rise more slowly.

The same can be seen from the algebraic expression for income. Income in Harrod's model is given by

$$Y(t) = Y_o\left(1 + \frac{s}{g}\right)^t$$

This equation also shows that as g increases the value of $Y(t)$ decreases.

The conclusion, then, is that if producers plan to invest a larger multiple of the increment of income, the growth of income will slow down. This might sound paradoxical. But mathematics cannot err and so it should be possible for us to prove this relationship between the accelerator and the rate of growth of income. We must first be clear about one point. Investment is taken to be induced ; it must, therefore, follow and not precede changes in income. If it is of an autonomous type it would be legitimate to argue that when producers invest an increasing multiple of increment of income, the growth of income would be accelerated. But induced investment must follow the leader and not lead itself. If, therefore, investment becomes a larger multiple of increment of income it must be because the mechanism of income-production needs such increased investment. For the production of a given level of income the system now needs a larger volume of investment. And such a system must be less efficient. It shows a higher ratio of capital to output. The income in such a case must grow less rapidly.

The accelerator-coefficient is, it is true, psychological in character and, therefore, has no direct relation to technology or capital-output ratio. But as we have already seen, it cannot for ever continue to be different from it.

CASH-BALANCES AND THE ACCELERATOR

The accelerator begins to operate when income increases and income increases when it operates. The accelerator and income, thus, act and react on each other. Once this interaction starts the two movements form a system of endogenous forces. But how does income first increase? And what is the nature of this increase? When a particular producer finds that the demand for his product has risen he plans to increase investment and then the accelerator comes into the picture. But the rise of demand for his product manifests itself to him by the rise of the price he can charge. And he is able to charge a higher price when the buyers elect to spend a larger part of their income on his goods. If this has to happen for the producers as a class, the income of all the buyers in the community must increase. But total income cannot increase (we are not considering here autonomous investment because our purpose is to find out what *initiates* the operation of the accelerator) by itself or till production has increased. But production cannot increase till income has increased, other things remaining the same. Remember here that we have to abstract from all influences that originate on the supply side. The only way, then, in which income can independently increase or the total expenditure of income can increase, is by the depletion of cash-balances held by the people. A certain part of money is always kept liquid—some is also converted into a (miser's) hoard—and due to some change originating on the demand side the people may decide to draw upon a part of their cash balances to satisfy their increased demand for goods. Once that happens the accelerator is stimulated into action. Thus, the initiating cause of the accelerator can be found to consist in the change in the volume of cash balances maintained by consumers. Were no cash balances kept by consumers this motive force behind the accelerator would have become inoperative. The maintenance of a cash balance is possible even in a barter economy where goods can be stored up instead of money. But it is clear that cash balances can be much more easily built up in a

money economy than in a barter economy. The accelerator is more frequently and more powerfully stimulated, therefore, in our modern money-economies.

Besides the depletion of cash balances there is another factor that can supply the motive force for the acceleration principle. When the demand for home-made goods from foreign countries increases production has to be undertaken to meet that demand. In such a case capital-goods have to be produced giving rise to accelerated investment. But increase of exports needs credit and, therefore, the banking system has to come to the assistance of producers. In the former case the system utilised its cash balances, in this case it has to create money.

We shall not consider here the case of increase of population as it is a long-period process; nor shall we study the effect on investment of discoveries of new resources and the application of new techniques to production as they are similar to that of foreign demand for domestic goods.

DOES THE MULTIPLIER ACT AS A CHECK ON THE ACCELERATION EFFECTS?

Does the multiplier or the savings-coefficient exercise any kind of damping influence on the increase of income induced by the accelerator? We saw above that when the acceleration-coefficient rises the rate of growth of income becomes slower. For, that is the only way in which equilibrium can be maintained between the higher investment-coefficient and the constant savings-coefficient. If investment has to be a higher multiple of increment of income while savings continue to be the same fraction of income, the increment of income has to be a smaller amount. This enables us to say that a higher rate of ex-ante investment meets with discouragement in the shape of retarded growth of income. And that is because the savings-coefficient does not cooperate with the investment-coefficient. The multiplier, then, exercises a check on the increase of acceleration-coefficient. These and similar statements (one such statement was made earlier in this chapter) sound paradoxical and it is only when they are properly explained that they unveil the truth contained in them.

CHAPTER 15

DOMAR'S MODEL

GENERAL OBSERVATIONS

HARROD'S AND Domar's names are generally bracketed and to an extent rightly too. Sometimes things that are similar appear dissimilar because the similarity is hidden. Again, things that are dissimilar appear alike because the dissimilarities are not obvious to us When we compare two models they, at times, appear different because we look at them from different angles. Sometimes they appear similar because we do not make a distinction between what precedes and what follows. In an equation, for instance, the two sides are equal but one of them may be the cause of the other. Which is the cause we may not care to determine. The causal relationship between two phenomena may be different in two models and yet both may have the same equation indicating the relationship between them.

The last point is important in the present context. Harrod's and Domar's models appear alike, and so they are in a way ; but their approaches are different. They are like two men reaching the same end by different roads. That the approaches are different may not be obvious to some because, as we have said, mathematical equations do not show causal relationships. If we say, for example, that consumption is four-fifth of income and express that relationship by putting consumption $C = \frac{4}{5} Y$, where Y is income, the equation does not tell us whether C comes first or Y. It does not tell us whether consumption is such and such because income was such and such or that income is such and such because consumption was such and such. Mathematical equations show equalities and not causalities. That is the disadvantages of mathematical treatment when one allows oneself to be saturated with numerical or algebraic symbols. Many a time economists have been dangerously indulgent and allowed themselves to be carried away by equations and geometrical formulations.

DOMAR'S PREMISES

Domar also gives importance to investment because, as we observed

earlier, it is investment that makes the moving economy move. Investment is the immediate cause of production and through it of consumption. Investment produces income and so creates demand for what is produced. But investment has its own supply side also. Investment increases production of goods. Thus there are two sides to the process of production : first ; there is the money side which is related to demand (for goods) and, second, there is the real or goods-side which is related to supply (of goods). Domar expresses both these effects of investment in his equations. The effect on demand, the income-generating effect, is common to many models and it is indicated by all expressions implying the multiplier effect. Investment produces income as a multiple of itself. This effect Domar indicates by the expression $\triangle I/\alpha$ Then, there is the effect on supply : investment increases the productive capacity. And it must, otherwise there is no meaning (real meaning) even in the multiplier effect. There may be more than one way in which productive capacity or productivity increases but with that we are not immediately concerned here. This increase of productivity (the effect on supply) is expressed by Domar as σI.

Domar assumes that there is full employment of factors of production. In such a state of an economy if income is increasing (and it can increase if productivity increases) what is the manner in which it must increase so that it may cause no disturbance to the system ? If the system is disturbed it will have its effects on employment of factors. The question, then, can be put in other words : what is the rate at which income should increase so that full employment can be maintained ?

To answer it Domar proceeds on the same lines as Harrod. The producers who are the captains of production should be in equilibrium. Harrod expressed this condition by equality of savings and investment. Domar expresses it by the equality of demand and supply. These are two ways of saying the same thing, though the approaches are slightly different. It is such small differences that might make one feel that the two models are different. All students of economics know that equilibrium requires the condition that demand must equal supply. Equilibrium means, here as elsewhere, the equilibrium of the state of the mind of a producer. But when demand and supply are equal, savings are equal to investment. This point need not detain us here as we have already explained it earlier.

Equilibrium condition is, therefore, expressed by putting demand equal to supply, i.e. by the equation $\frac{\triangle I}{\alpha} = \sigma I$.

Let us see what these symbols represent. $\triangle I$ is the additional investment. α is the savings ratio which we had assumed to be 1/5 in our example I is investment and σ is productivity of capital or the output-capital ratio Hence, σI is the increase of output .

It will be obvious, therefore, that $\triangle I/\alpha$ is the increase of income

$$\triangle Y\left(\frac{I}{\alpha} = \text{the multiplier}\right)$$

αY is the amount saved which in equilibrium or otherwise too is equal to I (saving is equal to investment) From these relationships it can be seen that $I/\alpha = Y$.

Hence,

$$\frac{\triangle Y}{Y} = \frac{\frac{\triangle I}{\alpha}}{\frac{I}{\alpha}} = \frac{\triangle I}{I} = \alpha\sigma$$

If, therefore, this condition is satisfied there is equilibrium. The rate of increase of income given by this equation would enable the economy to preserve full employment of factors. This rate is, therefore, equal to Harrod's warranted rate and since full employment is also assumed by Domar, it equals Harrod's natural rate of growth also. We have already expressed the relationship between warranted and natural rates of growth and between either of these and the actual rate of growth We need not therefore, say anything more on this point.

It will be seen that in Harrod's terminology $\alpha = s$ and $\sigma = \frac{1}{g}$ This latter equality is thus explained : σ is the productivity of capital. And productivity of capital equals output-capital ratio This ratio is the inverse of capital-output ratio which is equal to (tends to equal) g in long-run equilibrium Hence, $\alpha\sigma$ is the same as Harrod's $\frac{s}{g}$. Hence Domar's conditions $\frac{\triangle Y}{Y} = \alpha\sigma$ can be rendered into Harrods's terminology as $\frac{Y(t) - Y(t-1)}{Y(t)} = \frac{s}{g}$.

Thus, Domar's condition turns out to be the same as Harrod's.

IMPLICIT DIFFERENCE BETWEEN DOMAR'S AND HARROD'S MODELS

We have observed above that things that appear to be alike may not always be so. The equations giving us the condition for equilibrium growth of income are the same in Domar's and Harrod's models. But mathematics shows equality and not causality. When $A = B$, one does not know whether A has adjusted itself to B or B has adjusted itself to A. It might also be that each has adjusted itself to the other. Logically, we attribute causal character to one phenomenon and treat the other as effect. Cause preceeds the effect, if not historically at least logically. But a mathematical equation has no temporal character. It indicates, we might say, the ex-post relationships.

Both Harrod and Domar prove that for equilibrium growth of income the rate of this growth must be equal to s/g which is the same thing as $\alpha\sigma$. How this equality is arrived at is hidden in their postulates and in their treatment. Harrod says that investment is g multiple of increment of income But it is that amount because it adjusts itself to the increase of income. Income has first changed and investment has adjusted itself to it. Domar says that investment multiplied by σ is equal to increase of income. But he does not say that investment is such an amount because income has first increased. In his exposition investment first increases and income resulting from it is σ times the investment. The causal relationship between income and investment is reversed.

Since the equations give us the final position, or rather the final condition for equilibrium growth of income, it matters little how that condition was arrived at. They reach the same end, for the reason that the end is one. But they follow different paths. Do the different routes followed by them not take them to divergent ends? How is it that the path followed makes no difference to the final result?

The answer to this question must be sought in the interaction of the variables of the system. They act and react on one another making it difficult to say which is the cause and which the effect, once a movement has started. Which come first, the chicken or the egg? We have to go to the start of time to be able to answer such a question. The same is true of the question in hand. We

do not know the beginning of any economy. Logically too the various variables are interdependent For this reason the final result is not affected by the different postulates in the two models (the difference hinges itself on time-sequence).

There is another reason also why the different paths followed by the models make no difference to the final result. That is because the psychological coefficient (g in Harrod's model) and the technological coefficient (σ in Domar's model) adjust themselves to each other. This point was explained earlier also. Producers' psychology must be based on past experiences of technological behaviour of investment and must be adjusted from time to time in the light of further observation of technological behaviour

HARROD-DOMAR MODELS : DYNAMIC OR STATIC ?

In Harrod's model, equilibrium is sought immediately in the equality of ex-post investment with ex-ante investment and ultimately in the equality of savings and investment. The premises relate to ex-ante entities though by hypothesis savings ex-ante do not differ from savings ex-post. In Domar's model all the premises do not relate to ex-ante entities. The demand-side premise can be said to be ex-ante in character because of α which is the multiplier-coefficient with ex-ante implications as in Harrod's model But the supply side premise is pure ex-post showing the technological potentiality of investment. Thus, it is on the supply (investment) side that the Harrod-Domar difference shows itself But as we have argued, the difference tends to wipe itself out and in equilibrium solution actually succeeds in doing so.

It is here that the question poses itself whether these models are truly dynamic. For, it is maintained, there are no time-lags : in a dynamical analysis, variables at different moments of time should be incorporated and linked one with another. The link between the past and the present (leading to the future) must be maintained in a dynamical system. The only way to maintain it is to bring into our assumption inter-relationships between phenomena located at different points of time.

The above allegation is perhaps not fully justified as the time-lags enter into the equations through the concept of increase of income. Increment of income is a function of the past and the present. By making investment a function of increment of income the link

between different moments of time is introduced in the models. This increment appears in a direct way in Harrod's model while it is indirectly there in Domar's model. The charge against these models stems from the apparent absence of time-lags. It is supposed that since increments relate to the present there is no time-lag—no linking of different moments of time. But the concept of increment itself involves and necessitates comparison of two periods of time. Were time not involved in these models we would not have got an expression for the *movement* of income over time.

THE SIGMA EFFECT

We have many *effects* in economics, such as Pigou effect, Ricardo effect, Kalecki effect and sigma effect. The last one may be called Domar effect. Domar says, as we have already explained, that the supply side consists of capacity-increasing effect of investment. Investment increases productivity (or produces income). The output bears a certain proportion to capital and this ratio is represented by σ in Domar's model. The demand side, as we saw above, does not differ from the demand side in Harrod's model or many other models. But those models do not incorporate this output-capital ratio explicitly. That investment can, besides creating income for consumers, create capacity for producers is a fact that the other models seem to have ignored. Credit is, therefore, given to Domar for making this contribution to growth models. Due to the use of the Greek letter *sigma* this effect is called the *sigma effect.*

It should be remembered here that the *relation* of Harrod (denoted by the letter g) is similar to the capacity-producing indicator of Domar (denoted by the letter σ). As explained earlier in this chapter, g is a psychological coefficient while σ is a technological coefficient. Being technological it refers explicitly to the capacity-producing effect of investment. But the psychological coefficient cannot be entirely independent of technological coefficient. One cannot plan investment without taking into consideration the likely effect of it on production. As a matter of fact sigma is also not quite correctly known to producers. But the model builder equates the income-production (demand for goods) with goods-production (supply of goods) and in so doing takes the actual output-capital ratio into account. In that way it is made to appear

in the model in the manner in which it does not in other models. But, it should be obvious, the so-called sigma effect is also there in Harrod's model (though it wears a psychological mask).

CHAPTER 16

OTHER MODELS

CHARACTERISTICS OF OTHER MODELS

ALL MODELS must depend on the multiplier and the accelerator. We can simplify a model by ignoring the acceleration of investment but a fullfledged model must use both, the multiplying effect of investment on income and the accelerating effect of income or consumption on investment. That is the way of considering the action and reaction between consumption and production Consumption necessitates production and production enable consumption (of income, real or monetary).

The various models of Hicks, Samuelson, Phillips, Goodwin, Hansen, Duesenberry, Kalecki, Smithies and others can be derived from one another by making slight changes in the form and character of the multiplier and the accelerator. For instance, we can make the multiplier a variable figure, i.e. make the consumption function non-linear, and so also the accelerator. We can make investment a function of income or of consumption, we can make consumption a function of income of the past period or of past periods by introducing time-lags. When more than one past period are involved the time-lag is a distributed one. Similarly, investment can be made a function of consumption or income of the past period or periods We can also make it a function of some exogenous constant or an exogenous variable, in which case such investment can be called autonomous. We can also introduce an autonomous element in consumption and make it, if we like, variable. We can, further, make consumption and investment functions of future (expected) incomes. By thus varying the character of our multiplier-coefficient and accelerator-coefficient we can have a large number of models of a fluctuating or growing economy.

HICKS-SAMUELSON MODEL[1]

Just as Harrod's and Domar's models are similar, so also are Hicks' and Samuelson's. There are some important points in which their

models differ from those of Harrod and Domar The first point of difference is that income lags behind consumption by one period and increment of income also lags behind investment by one period of time. Then, it is assumed that ex-post consumption equals ex-ante consumption. It will be recalled that Harrod's assumption was that savings plans are realised. But in the models we are considering now it is assumed that if income deviates from the expected figure it is savings that will absorb the shock and consumption will not be allowed to suffer. Thus, there can result, due to unexpected changes in income, unintended savings or dis-savings. For equilibrium, then, investment plans must be realised, i e ex-ante investment must equal ex-post savings (a variable figure now). This condition for the equilibrium of the economy and, therefore, of producer's mind remains the same as in previous models And there is no escape from this condition . we have repeatedly mentioned the fact that producers are the captains of economic activities and it is they who must be in equilibrium if production has to proceed smoothly. That does not imply, however, that in such a case of equilibrium all the factors of production are fully employed. It only means that those who are immediately responsible for production and, therefore, for the employment of factors of production, are satisfied with the manner in which the economy is behaving

Let the consumption function and investment function be, then, expressed as follows :

$$C(t) = cY(t-1)$$
$$I(t) = B\,[Y(t-1)-Y(t-2)]$$

c is the multiplier-coefficient and B the acceleration-coefficient. Since it is assumed that ex-post consumption is the same as ex-ante consumption the consumption function is both ex-ante and ex-post The investment function is a pure ex-ante function. B is, therefore, a psychological coefficient. For equilibrium income must equal the sum of consumption and investment. This condition is similar to, rather identical with, the condition of equality of savings and investment. For equilibrium rate of growth, therefore,

$$Y(t)=cY(t-1)+B[Y(t-1)-Y(t-2)] \qquad (1)$$

or

$$\frac{Y(t)-Y(t-1)}{Y(t-1)} = (c-1) + B\left[1 - \frac{Y(t-2)}{Y(t-1)}\right] \qquad (2)$$

What does this equation show? If income is increasing, $Y(t-1)$ is greater than $Y(t-2)$, making the second part of the right-hand expression positive. Since $c-1$, which is negative, is small as compared to the other part of the right-hand expression, the whole right-hand side is positive. The left-hand side, therefore, is also positive. Hence, the rate of growth of income is always positive. Further, if income is increasing, the right-hand side is also increasing giving us an increasing rate of growth of income (as the left-hand side would also be increasing then).

We get, therefore, the same result as in the models of Harrod and Domar. Increasing income must keep on increasing by greater and greater amounts to sustain its growth.

Now let us solve equation (1)

Put $t=1$

$$Y(1)=cY_0+BY_0-BY_{-1}$$

Let $Y_{-1}=100$

so that $Y(1)=Y_0(c+B)-100B$

Putting $t=2$

$$\begin{aligned} Y(2) &= (c+B)Y_1-BY_0 \\ &= \{Y_0(c+B)-100B\}(c+B)-BY_0 \\ &= Y_0(c+B)^2-BY_0-(c+B).100B. \\ &= Y_0\{(c+B)^2-B\}-100B(c+B) \end{aligned}$$

Proceeding in this way we can determine the values of $Y(3)$, $Y(4)$, $Y(5)$, etc. These values would show that increase of income progressively takes place as we pass on from one period of time to another and greater is c or B greater is the rate of growth of income.

In this model the increase of the acceleration-coefficient B does not slow down the rate of growth of income. That is because of the time-lags

We should remind ourselves once again that the rate of growth indicated by the above equation is not necessarily the rate at which income would actually grow. It only gives us the rate at which income should grow in order to keep the producers satisfied. And the producers would try to manage their affairs in such a way as to remain in equilibrium. But for that, a continuous increase in the supply of factors is needed. If we were to start from the position of under-employment the condition necessary for income to grow so as to keep the producers in equilibrium would be avail-

able to the economy. Once, however, the existing resources are fully employed we have to depend on some exogenous influences to stimulate the growth of factors of production. Since natural resources (measured in terms of physical units) cannot increase we have to look to human factors for the required increase of productive factors. When population increases all human factors can increase and make possible a better use of natural resources. The limitation of the quantity of natural resources imposes upon us the necessity of improving their quality if production has to increase. Such an improvement can be expected when population increases. For, increase of population would ensure better organisation also.

DISTRIBUTED LAGS

Let us now make consumption depend on the income of the past two periods. When the propensities to consume of the two periods is different the case becomes one of distributed lag. Let investment remain a function of increment of income as before. We then get the two ex-ante equations as before.

$$I(t)=B[Y(t-1)-Y(t-2)]$$
$$C(t)=c_1Y(t-1)+c_2Y(t-2)$$

Imposing the condition for equilibrium growth of income we get the equation $Y(t)=cY(t-1)+(B-c_2)\ [Y(t-1)-Y(t-2)]$ where $c=c_1+c_2$. The reader is advised to consult Professor R.G D. Allen's *Mathematical Economics* where this model as also other variations of it are beautifully explained. Our object is not to take delight in the Mathematical manipulation of our models but to understand their economic and, at times, philosophical implications.

The equation (3) above is of the same form as in our previous model with the only difference that instead of the accelerator coefficient B it is now $B-c_2$ showing that the accelerator effect is weakened. The propensity to consume out of the income of the period $t-2$ has a damping effect on the acceleration of investment. The equation given above can be solved to give us the value of Y over time. As Professor Allen shows, by giving different values to $B-c_2$ we can get different types of income path. We can get damped path and explosive path and each of the two varieties, oscillatory and non-oscillatory.

High values of the accelerator give us explosive variations of

income while low values give us damped variations. And naturally when the accelerator takes values in between high and low the income oscillates.

All through, in treating these cases, we assume that the framework within which the variables of the system operate is elastic, i e. the factors of production can increase without encountering the ceiling. If the psychology of the consumers and producers meets with no opposition from the side of exogenous forces the desire for equilibrium on the part of producers would yield the growth or fluctuations of income as described above. The exogenous forces referred to above relate to the growth of population with the accompanying increase of organising ability. When these are available for the psychological factors to function unobstructed, capital grows and technology improves as required by the model.

ECONOMIC AND PHILOSOPHICAL INTERPRETATION

Let us see what the mathematics of the above model tells us in the language of economics. We have seen that c_2 exercises a damping effect on the acceleration of investment. The economy, therefore, progress less rapidly than otherwise. In other words, when consumers' behaviour is influenced by the remoter past (the period before the immediate past) the accelerating effect on production is weakened. The consumers pull the economy backward, as it were, by psychologically dwelling on the dead past. And the remoter past is, in terms of income, less exhilarating than the immediate past or the present in cases of growing income. If the economy has to make a rapid progress it should cease to live mentally in the past which is less glorified than the present. We are advised by great thinkers and by our scriptures also that we should always live in the present if we have to live happily and lay a true foundation for a happier future. Knowledge is all pervading and we can get it whenever and wherever we want it. Economics is one of the means of getting it. When we go deep into any science, knowledge uncovers itself.

GROWTH OR FLUCTUATIONS DETERMINED BY PSYCHOLOGY

In the model just considered, i.e. where the remoter past also determines the behaviour of consumers, the variations of income

differ with changes in the multiplier-coefficient and the accelerator-coefficient. As we have said, and as Professor Allen has so well explained in his Mathematical Economics, income can grow or fluctuate depending on the relative values of the two coefficients. These coefficients operate within a given framework. We have the initial income to start with as also the initial increase of income which are taken as given data.

If income increases it is because the interplay of the multiplier and the accelerator, operating within the parametric framework of the economy, leads to increasing use of factors of production. When there are oscillations in income it is because the interplay of the same forces is such as to lead to increasing and decreasing application of factors of production to nature-given resources. In general terms it can be said that oscillations or fluctuations are the result of overshooting (and undershooting) of the mark—the play of forces is not harmonious. The economy overfeeds and underfeeds itself by turn.

It is thus the psychology of producers and consumers that determines the course of income. The employment situation at any time is the result of anticipations and stored up experiences of the past To direct and determine the flow of income we have, therefore, to create forces to operate on the mental plane of an economy.

UNEVEN FLOW OF ECONOMIC FORCES

The forces that guide economic activities do not flow evenly; that is because the plane over which they travel (or the medium through which they exert their influence) has obstructive elements. The main or perhaps the only ditches and hills on the path of travel are caused by production which by its very nature is a prolonged and delayed-action activity Consumption is conceptually an instantaneous phenomenon but consumption and production are in practice intermingled. They can be separately conceived of as aspects of the same activity. This jerky and uneven flow of energy can be pictured in terms of lags. The most important lag is caused by the time-interval that must elapse between decision and action. The mind or mental activities precede matter or physical activities. There are further time-lags at successive stages in the activities that culminate in the final con-

sumption of goods. First decide to produce, then spend money and place orders. The execution of orders for capital-goods takes time ; their utilisation for purposes of production is also a time-consuming process. When goods are ready they pass through various agencies before they reach the final consumers. And then there are consumers who also cause such delays (for they too have their production aspects) by taking decisions before they are implemented. Thus, without making an exhaustive list of such lags, it may be noted that economic forces, operating within and through a given framework, do not maintain an even flow.

The uneven flow of these forces causes time-lags of various description. But we need not consider all of them, incorporating them in our models We do not study models for the delight that their mathematical manipulation provides. That is no doubt the main object of a theorist ; but we have a special purpose here. We want to understand the economic significance of these models and see if we can discover from them some facts of philosophical import. The tendency to get lost in the mathematics of our solutions and then to identify ourselves with pure mathematicians is very much there and the one way in which we can protect ourselves against such tendencies is to keep our objectives always in our mind, namely, that we want to discover facts of economic and philosophical import. We shall, therefore, not study all the excellent models constructed by economists with the use of various time-lags ; we shall mention only some of them here. They deserve our attention, they deserve to be made popular.

A MODEL WITH CAPITAL-STOCK REQUIREMENT

We had an occasion to introduce capital-stock in our model but let us see how we can make a full use of it in building a dynamic model. There are two aspects relevant to all calculations : first, there is the income aspect and, second, the capital aspect. Our results are judged by the income that flows from, or the capital that is built by, our productive activities. Are we interested in the income-producing or capital-building aspect ? This is a disputed point in economics. The income-producing aspect is associated with the concept of *maximisation* while the capital-building aspect is associated with the concept of *equilibrium.* Witness here the contribution of Boulding to economic analysis. Professor Bould-

ing maintains that an operating unit is interested in the stock of capital that he is able to build up besides being interested in the income that he currently enjoys. A producer has not only his profit and loss account, he has also his balance sheet, says Professor Boulding.

Goodwin builds a model with this requirement of a capital-stock. True it is that capital is wanted perhaps only because it produces income; true it may be that we attach importance to income only because it enables us to build up a stock of capital. It need not be argued here that each of these points of view has its own justification Let us proceed to throw some light on Goodwin's model.

It is supposed that consumption is a fixed proportion of income without a lag. There are induced and autonomous investments These together make up income. That gives us the first equality namely.

$$Y = C + I + A$$

where I is induced investment and A autonomous investment If autonomous investment is assumed invariant with time, we get

$$Y = \frac{I + A}{1 - c}$$

where c is the proportion of income consumed.

Now let us introduce capital-stock into the picture. Suppose, with Goodwin, that the object of investment is to build a capital stock. Remotely it has the object of producing income that is demanded and found profitable. But immediately investment is wanted for the sake of building up a stock of capital Investment here is a flow that goes to impinge itself on the existing stock of capital. Capital-stock is maintained through replacement of wornout equipment and it is increased through net investment Gross investment includes replacement.

We can now introduce behaviour-equation in terms of capital-stock for the producers. Suppose they want to have capital assets equal to $\bar{K}$. Make this intended capital-stock a function of income and of technological advancement. In that case the first part may be called induced part of capital-stock and the latter, autonomous part. Represent it by the equation

$$\bar{K} = gY + at$$

g being the proportion of income that goes to make up for the

induced part of capital-stock, and a stands for the constant rate of technological improvement.

If we differentiate both the sides with respect to t to get the rate of increase of capital-stock desired by producers we have the following equation :

$$\frac{d\bar{K}}{dt} = g\frac{dY}{dt} + a$$

Equilibrium of the system is again defined by the equilibrium of the *state of mind* of producers. That requires that their intended stock should equal the actual stock of capital. Actual stock of capital is built up by investments so that it grows at the rate of I. Hence we have

$$I = \frac{dK}{dt}$$

We have now three equations that describe the model. The first gives the income in terms of investment and the propensity to consume, the second gives ex-ante stock of capital in terms of income, capital-income ratio and technological developments, while the third gives us the rate at which capital-stock increases (which equals investment).

Solving these equations we can get the values of income (Y) and ex-ante capital-stock in terms of coefficients c, g and a and autonomous investment.

It is shown by Professor Allen that in equilibrium the two stocks, ex-post and ex-ante are equal at the value $\frac{g}{1-c}(A+a) + at$ and income equals $\frac{A+a}{1-c}$.

As Professor Allen has not given the various steps in the solution we give them below for the benefit of those who may be interested in the mathematical part of the result.

$$Y = cY + I + A \qquad \bar{K} = gY + at$$

$$= cY + \frac{dK}{dt} + A \quad (1) \qquad = \frac{g}{1-c}\left(\frac{dK}{dt} + A\right) + at \quad (2)$$

by substitution from (1)

$$\therefore \qquad Y - cY = \frac{dK}{dt} + A$$

$$(1) \qquad Y = \left(\frac{dK}{dt} + A\right)/1-c$$

In equilibrium $K = \bar{K}$

$$\therefore \text{ from (2) } K = \bar{K} = \frac{g}{1-c}\left(\frac{d\bar{K}}{dt} + A\right) + at \qquad (3)$$

and since in equilibrium $\frac{d\bar{K}}{dt} = I = a$

(3) can be written as

$$K = \bar{K} = \frac{g}{1-c}(a + A) + at$$

(1) becomes $$Y = \frac{a + A}{1 - c} = \frac{I + A}{1 - c} = \frac{I + A}{s}$$

Income in equilibrium equals the familiar multiple of investment —the multiplier being the propensity to save

The value of Y given above is the equilibrium value in the sense that it is the income that makes the ex-post and ex-ante capital-stocks equal Once that equality is reached no change can occur in the generation of income. But if we start with a position where the two stocks are different a situation of over or under-investment would prevail It can be shown, then, that the attempt to make adjustments would result in cycles of boom and depression. But with the mathematics of that we need not bother ourselves.

A FURTHER CAPITAL-STOCK REQUIREMENT MODEL

We can make our models as complicated as we like by incorporating in them further and further features of an expanding economy. In the last model we took account of the influence of capital-stock or rather we adopted the capital-approach in building the model. Professor Duesenberry gives us a more complicated model in which he takes account of the inter-relationships between income, consumption, investment, capital-stock (both business and housing), profit, dividend, depreciation and business debt. But in order to simplify the model he reduces these relationships in number and builds an income-generating model with the following four equation :

$$I_t = \alpha Y_{t-1} - \beta K_{t-1}$$
$$C_t = aY_{t-1} + bK_{t-1}$$
$$K_t = (1-K)\,K_{t-1} - I_t$$
$$Y_t = I_t + C_t$$

Here a is the marginal propensity to consume, b is the index of

the effect of changes in capital-stock on consumption. This effect is, naturally, *via* profit and dividend. α represents the effect of changes in income on investment, β reflects the influence of capital stock on investment. In all normal cases β is negative as the greater the accumulated stock of capital, smaller is the additional investment that is felt necessary (and profitable). Likewise, b is usually negative as greater the stock of capital smaller is profit and therefore, dividends, with the result that consumption is less. a and α are positive.

The third equation above shows that capital-stock at any given time is equal to the stock carried over from the past increased by fresh current investment.

By substitution we can get the following two equations in Professor Duesenberry's notations :

$$Y_t = (\alpha + a)Y_{t-1} + (\beta + b)K_{t-1} \quad (1)$$

$$K_t = \alpha Y_{t-1} + [\beta + (1-K)]K_{t-1} \quad (2)$$

These are further simplified by putting $\beta = -1$ and $K=0=b$. $k=0$ means that depreciation is incorporated in investment and $b=0$ means that the influence of profit on consumption is ignored. After these simplifications we get

$$Y_t = (\alpha + a)\ Y_{t-1} + \alpha(-1)Y_{t-2} \quad (3)$$

This equation shows that if the income in the beginning increases ($Y_o > Y_{-1}$) it will keep on increasing if equilibrium is to be maintained ; conversely, if income starts decreasing it will keep on decreasing.

This is shown as follows :

$\frac{Y_t - Y_{t-1}}{Y_{t-1}} = \alpha + a - 1 - \alpha\left(\frac{Y_{t-2}}{Y_{t-1}}\right)$; obtained by dividing both sides of equation (3) by Y_{t-1} and subtracting 1. If $Y_{t-1} > Y_{t-2}$ the right hand side, which can be put as

$\alpha\left[1 - \frac{Y_{t-2}}{Y_{t-1}}\right] + a - 1$ will be positive unless α is small and a is also small. For all reasonable values of α and a the right-hand side is positive, making the left-hand side also positive that means that income in period (t) is greater than in period $(t-1)$—income is increasing.

What is the economic significance of the condition that income would go on increasing provided a and α are large enough ? It

means that for the increase of income what is needed is that investment should be sensitive or sufficiently sensitive to income and consumption should also be sensitive, in a large measure, to income. The first part of the condition implies that there must be a fairly strong desire on the part of producers to take advantage of increasing income (a condition that rest in the final analysis on the capital-output ratio) while the second part implies that consumers should take good advantage of increased income to better their condition. If they care more for the future than for the present the propensity to consume would be low. Producers should, therefore, be very willing to make provision for the future (and the system should make such a provision necessary through the influence of a fairly high capital-output ratio) and the consumers should be willing to take advantage of the results of such a provision made by producers.

The observations we have made here are important. In mathematical language we can say that the parametric constants (here a and α) of the system should have values lying within a certain range. Such an expression, correct in itself, hides important truths of economic significance which we have stated above and which it is our intention all through this book to reveal.

It can be shown by rendering equations (1) and (2) above in terms of K that for a growth of capital-stock similar conditions are necessary. One point must be emphasised here, for it bears repetition, *viz.* that the steady growth indicated by the above equation is only a hypothetical rate of growth in the sense that it is *the rate at which if the income was to increase, equilibrium would prevail in the economy*. Equilibrium is defined in terms of human psychology which ensures also that investment equals savings or the total income of the factors of production in one period should pass on in the succeeding period to producers. But, *and this is important to note*, this growth rate requires some physical means of subsistence, as it were. The factors of production must grow proportionately if the technical coefficients of production are fixed or disproportionately if the coefficients are variable. And that implies growth of population and/or improvement of organisation. The framework within which the economy lives and expands must itself be elastic. To proceed with such models assuming that other things remain the same, is to commit a logical fallacy.

When the actual rate of growth deviates from this psychological

rate investment and savings become unequal leading to increase of stock above or below the required limit. Further, if in the initial stage stock of capital is greater than required, the behaviour equations would lead to a still greater stock of capital. Over production would result and conditions would progressively deteriorate. Thus, for a steady rise of national income two sets of conditions are required. First, the sensitiveness of consumption and investment to income must be of a certain intensity and, second, the state of the economy at the starting point must be consistent with equilibrium rate of growth. Since a starting point is not possible to imagine, the second condition can be restated more meaningfully in the following words : *the economy must be free from disturbing influences that cause the stock of capital to increase more or less rapidly than is consistent with equilibrium rate of growth of income.* In philosophical language our smooth and happy progress requires, first, that we should be free from evil influences of exogenous factors and, second, that our own attitude to the present and the future (consumption and investment) must be reasonable and rational. Reasonable because the consumption coefficient and investment coefficient must individually have certain values and rational because their relationship should be of a certain nature (the ratio of the two coefficients should be such as to allow a continuous growth of income).

A MODEL WITH ANOTHER TYPE OF LAG

We have already seen how all variations in the production of income can be attributed, in the final analysis, to the fact that production is a time-consuming process and that such a consumption of time is a jerky one. Were economic activities to flow evenly and smoothly there would be no fluctuations of the type that we witness in the course of the economic history of a community. There are many kinds of lags in a system and these lags are a mere manifestation of the time-consuming nature of production. Consumption-lag, which means income lagging behind consumption and investment-lag meaning income or income-changes lagging behind investment have been noted. Now let us note, following Kalecki, that the decision to invest can also lag behind actual investment. Kalecki has built a number of models, starting with a simple one and then introducing elaborations in

it. Our object is not to study the mathematical processes involved in the construction of those models and so we shall satisfy ourselves with a brief description of a model involving decision-lag of Kalecki type.

Let us take the behaviour equation of consumers or rather income-owners and the behaviour equation of producers which means investers Producers' part in the generation of income is best described by their investments So we suppose that consumers consume c fraction of their income without a lag. As far as the production side is concerned let us suppose that decision to invest matures after an interval of θ and that all along this interval of θ units of time there is expenditure of money by the producers This expenditure sums up to an amount that we call (total) investment by the end of the period θ This expenditure then results in capital which becomes available for productive use The time sequence is as follows. Decision to invest, leading to continuous expenditure on the procurement of capital-goods over a period of time (θ) and then the actual receipt of capital-goods at the end of θ time that is, at time (t). These steps can be expressed by the following equation

$$I(t) = \frac{1}{\theta} \int_{t-\theta}^{\theta} D(t, dt \qquad (1)$$

$$\frac{d}{dt} K(t) = D_{(t-\theta)} \qquad (2)$$

The first equation gives us the investment at time t, as the rate of capital-goods-*ordering* which is obtained by integrating summing up) $D(t)$ over the gestation period θ, preceding time t, and then taking the average $D(t)$ represents decision referred to time t.

The second equation shows the rate of capital-goods *procurement*. $\frac{d}{dt} K(t)$ shows the rate of increase of the stock of capital-goods which equals the decision to invest taken θ units of time in the past.

For the final solution the reader may consult the excellent book of Professor Allen referred to above.

The decision to invest is made to depend on savings (current, and the stock of capital that already exists. and over and above these endogenous factors there is an exogenous factor on which

decision to invest is made to depend. This factor can change but its variations cannot be endogenously determined.

Let then $$D = aS + kK + \epsilon \qquad (3)$$

a shows the influence of savings on investment-decision, k shows the influence of capital-stock and ϵ is the exogenous element of the decision. k, it may be noted, will be negative in all normal cases while a will be positive.

These three equations, together with the equality of income to consumption plus investment, can be solved to get the dynamic values of the variables. As Professor Allen shows, the deviations of income from the equilibrium value are given by $\frac{K(t+\theta)-K(t)}{\theta(1-c)}$ where $1-c=S$.

It will be seen from the above value of income that it depends on the increase of capital with the usual multiplier $(1-c)$ effect in units of θ length of time. If we can determine the value of K at different times we can trace the path of income over time. The value of K depends, as can be shown, on the coefficients in the behaviour equations and the time interval θ (the lag in decision to invest). The equation that gives us the dynamic value of K turns out to be a difference-differential equation, *i.e.* it involves terms that show difference between the values of a variable at two moments of time (here it is two moments only) and another term which shows the differential of a variable, i.e. the rate at which it is varying. With these we are not concerned. Let us repeat, our object is not to understand the mathematics of our models but their economic significance.

Mathematicians have worked out that capital-stock in this model would oscillate, the nature of oscillation depending on the values of the coefficients. If capital-stock oscillates the income must also oscillate. For growth we need to depend on exogenous influences on the decision to invest.

Again, here we find that income can grow but that it meets with obstructions and the interaction of the psychology of consumers and producers is such as to lead to decreasing and increasing incomes. In such cases the scarcity of factors of production does not impose added restrictions on the movement of income, though due to variations of prices (relative prices) of factors the course of income over time would be a affected.

INCLUSION OF CAPITIAL-STOCK AND WHAT IT IMPLIES

In some of the models briefly mentioned above attempt has been made to understand the working of an economic system through the impact of capital-stock on the psychological behaviour of producers (producers directly and at times consumers indirectly). What fundmental difference does that make to our approach to the problem? Production is a means and consumption an end. Consumers' interest are served by producers. The economic machinery can be conceived of as a direct interplay of two macro forces, forces of consumption and production expressed in their operation by the behaviour (equations) of income-producers and income-spenders. Now, when we introduce capital-stock in our models we bring into the picture an intervening stage in the production of income. There is production of capital-goods first and then through them the production of consumption-goods. In the models that take no account of capital-stock this stage is skipped over by allowing capital considerations to be incorporated in the behaviour of investors that is shown as depending on income or its rate of increase. When capital is specifically mentioned as affecting the investors' decisions production appears as a two phased activity, though in a running economy the two phases appear concurrent.

The effect of such a breaking up of the process of production into two and then their coupling together in our models is merely to make the process of production (or to recognise it as) more jerky; the flow of economic forces becomes more uneven. Income generation, therefore, becomes a more complicated affair and its study mathematically more difficult If we could imagine a stage in the development of economic technique in which the gap between production and consumption is reduced to a vanishing point, income would show no variations at all, either of growth type or of fluctuation type And in such a technique all the variations, if and when they occurred, would be caused by exogenous influences; there would be no endogenous variations of income. In the absence of exogenous forces the stable income would then be consistent with full employment of resources Keynesian under-employment phenomenon can, thus, be attributed to the time-consuming nature of productive activities with their uneven (circular) flow of energy. This is the economics of the models; this is the economic lesson that the models teach us.

CHAPTER 17

GENERAL CONSIDERATIONS: GROWTH AND FLUCTUATIONS

COMPOSITION OF AN ECONOMY

AN ECONOMY consists of animate and inanimate objects co-operating for purposes of self-preservation and self-aggrandisement. That which exists wants to continue to exist. That is the first law of nature. Individually and cooperatively the factors try consciously, or function unconsciously, to preserve themselves. Besides that they have the want to make a progress; whatever they find necessary for self-preservation they want to augment. Not only to live but to multiply; that is the nature of all objects. For the purpose of living as also for that of growing the various animate and inanimate objects that we call factors of production unite. They help one another in the satisfaction of wants that subserve the purpose of self-preservation and self-aggrandisement. The constituents of an economy are, then, these factors that unite, that work together.

ECONOMY IN ACTION

When the various factors of production help one another in the satisfaction of wants they create a picture of an economy in action. It is here that production and consumption appear separated as means and end The means involve sacrifice—sacrifice of some (sub-) ends precedes the attainment of final ends. But there cannot be more than one end in the ultimate analysis The one final end can be conceived of in various ways; the pursuit of this point would lead us to metaphysical speculations.

The picture of an economy in action is one, therefore, of production followed by consumption. But this round repeats itself for two reasons. First, for self-preservation a continuous process of consumption is needed for the sake of making good a continuous wasting of the self. Animate objects, more than inanimate ones, are subject to wear and tear. Self-preservation needs, therefore, a continuous process of consumption. The second reason for the

repetition of the round is that an economy is a macro-concept in which *individual units* die but the *whole* continues to live. The old ones disappear giving birth to new ones which demand consumption. The round of production and consumption has, therefore, to keep on repeating itself

OBJECTIVE RESULTS OF PRODUCTION

Production required for self-preservation and self-aggrandisement results in the creation of wealth (including use of wealth) This wealth consists of goods which can be directly consumed and others which help to produce such goods. The former are called consumption-goods, the latter capital-goods. The objective results of production are, therefore, these two types of goods. The former of these give rise to the concept of income, the latter to that of capital-stock. When these two varieties of goods are put to use they enable the operating units to make good their waste (wear and tear) and to grow or multiply. These then constitute the more ultimate objective results of production.

An economy in action is, therefore, necessarily a picture of growth superimposed on that of preservation. But to accomplish these results an economy has to put up a fight against opposing elements of the environments within which it functions. These opposing elements thwart the objectives of an economy due to which the process of growth is disturbed and the phenomenon of fluctuations is witnessed. Growth is temporarily turned into decline and income and capital, instead of continuously increasing, begin to oscillate from time to time.

Production that makes consumption possible consists in making available to the economy consumable goods through a series of capital-goods. In our modern economies all productive activities involve the use of money. At every stage production exhibits itself as an act involving expenditure of money. This gives rise to the concept of investment There is, then, investment of money, followed by activities resulting in the production of capital-goods. The use of these goods makes consumption-goods available to the economy.

But the capital-goods once they come into existence are found to be subject to the same process of decay as animate objects. They have a span of life ; they have to be preserved during this

span and, in the interest of the economy, they have to grow. The existence of capital-goods thus introduces a new element in the system: instead of animate objects there now arises an inanimate object that seeks self-preservation and self-aggrandisement. Production becomes double-phased, producers' psychology begins to work through capital-goods. Our models have to incorporate a new significant variable through which psychology functions.

FRICTIONS AND DELAYS

There are stages through which an economy has to pass in order to be able to survive and to grow. Its efforts do not flow in a continuous stream; it is in the very nature of such efforts that they proceed with jerks. Further, they encounter opposition from unfriendly elements of their environments. These, together with the fact that the human mind stores up past experiences and anticipates future events, delays the response of the system to stimuli acting on it.

While the efforts to survive, strengthened by those to develop, lead an economy forward, its delayed responses to stimuli push it backward giving rise to the phenomenon of fluctuations along a rising trend. A model of an economy must, therefore, exhibit these features. The endogenous forces operate to cause growth but the opposition they encounter, which is partly endogenous in nature but is also in an important way exogenous, retards that growth. The opposing elements internal to a system are provided by the scarcity of factors (together with the delayed responses mentioned above). Often these are regarded as exogenous to the system and, therefore, treated as parameters. True it is that the supply of these factors of production is not as much in our control as the production of goods: perhaps we have to depend on Nature's generosity for the increase of human and non-human resources. But while other factors are mainly agents of production the human factors are both agents of production and consumers of wealth. The growth of human beings is, therefore, not always an unmixed blessing. And yet, it must be noted, even capital needs sustenance and it feels the need (through its owners) to survive and to grow.

THE REALISM OF MODELS

The economy of a country, as explained above, grows with the

passage of time but there are lapses from it due to the reasons already mentioned. A model of an economy that is meant to portray these fluctuations and growth of income should incorporate the essential and fundamental features of a system that is endogenously expanding but has to encounter opposition from within and without

We have seen that the models so far studied are capable of giving us various types of fluctuation and increase of income Fluctuations that are exploding must be ruled out as no economy is characterised by such violent oscillations they are physically impossible. Nor can damped or converging oscillation be accepted, as economic history does not show that there is a tendency for fluctuations of income to annihilate themselves Nor does our knowledge of human nature lend any support to such variations A model yielding income that oscillates with mathematical precision also has to be rejected. Affairs of human life do not possess such a rhythm of movement

Though every economy makes progress, slow or rapid, we cannot approve of a model that yields income increasing at an exponential rate, nor any that makes it increase evenly and smoothly with mathematical precision What is needed, therefore, is a model that gives us uneven oscillations of income around an unevenly rising trend. But we must realise that it is perhaps not possible to construct such a model. A model that possesses realism is beyond our capacity to construct : nor perhaps do we need to have such a model Our real object is not to conquer mathematics ; we want merely to understand why income grows and why it fluctuates. Our knowledge shall always remain imperfect. There is something that will for ever remain hidden from our eyes, there is something that will defy our comprehension It is enough to know that there are certain forces that make us expand and there are others that obstruct such an expansion. Let us not be greedy, let us not attempt an impossible task Let us reserve our energies for better things to do

UNDER-DEVELOPMENT

While the network of forces that inhere an economy continue to give an upward push to it there are times when such a disharmony prevails among them that this push is kept in abeyance. The

phenomenon that is witnessed in such a case has come to be called under-development This words needs, for theoretical purposes, to be carefully defined but we are not concerned with that here. It is our object to emphasise the fact that at times endogenous and exogenous forces are so poised one against the other that the development of an economy remains stunted

An economy is very much like a living organism, if it is not quite identical with it. It has the capacity to expand from within and it exhibits the same phases of growth and decay as a biological organism.

In the same way in which the growth of a living being becomes stunted, the development of an economy also gets stunted. And when that is observed we must look for causes similar to those that operate anywhere else in the organic world.

Growth that is natural to an organism is a symptom of health, and health is the manifestation of a balance of internal forces, their rhythmic dance There must be some imbalance in a system that does not grow in a natural way. If an economy is under-developed and remains under-developed, this imbalance must be corrected. It is not our intention, however, to suggest by implication that every kind of growth is desirable. Over-growth is as much a symptom of disease as under-growth. Some of our modern economies, it may be, are suffering from over-growth. There is an optimum for everything Growth must be natural and moderate if it has not to result ultimately in a rapid and premature decline. It is as necessary to investigate into the causes of over-growth as it is to enquire into the causes of under-growth. It is difficult to compare the two maladies but at times one begins to wonder whether it would not be better to remain at a sub-normal level than attempt to jump to a risky height.

CHAPTER 18

CYCLES AND GROWTH: THEIR RELATIONSHIP AND MUTUAL CONVERTIBILITY

CYCLES AND GROWTH IN A SYSTEM

IN THE context of our present study income is the end product of economic efforts. In reality, the end product is the utility derived from consumption. But as our study is conducted mostly in terms of concrete, quantifiable things, we consider income to be the end product. In the treatment of macroeconomic problems we encounter the difficulty of aggregation and so we find it convenient to measure income in terms of money, though in our models the analysis often runs in terms of real income produced.

In an economy it is hard to find purely cyclical fluctuation of income or a pure instance of growing income. What is actually found is income fluctuating and growing: fluctuation shows a cycle or a combination of a number of cycles of different amplitudes. Growth of income may be observable over a short or a long period. Over a long period we find growth turning into decline and decline turning into growth. But if we take a still longer period we might find a gradual growth.

Growth of income is due, as we have shown earlier, to the use of a larger quantity or a better quality of factors of production. In one word, we can say that continued or continual growth can only be attributed to the increasingly effective part that organisation comes to play in production as man's knowledge, mainly of control of and command over forces of Nature, becomes more and more perfect.

CYCLES CAUSED BY TIME-ATTRIBUTE OF ECONOMIC PHENOMENA

Once income begins to increase it must continue to do so till some force or forces that act in the opposite direction interfere with those that cause income-growth. These interfering forces might be either endogenous or exogenous to the system that produces income. In the former case the cycle is said to be endogenous in

character—the economic system is inherently unstable or cyclical—while in the latter case the cycle is said to be exogenous in character. In one case the cause of cyclical fluctuation of income is within the system, in the other it is outside the system.

Confining our attention to endogenously caused cycles we can say that the interfering causes or forces are generated by what is conveniently called, as explained earlier, time-lags. Economic phenomena do not take place all at once—changes in income or those in the variables of an economy are not simultaneous in their occurrance. One change is *followed* by another change and is not *concurrent* with it. This phenomenon is called time-lag. There are various kinds of time-lag which we might associate with occurrances on the demand side or on the supply side. But whenever there is time-lag we can say that the smooth course of economic growth is disturbed. Time-lags act as jerks to the system. The even flow of economic forces that produce income gets ruffled.

There can be no time-lag unless there is time, i.e, unless our economic system acquires time-attribute. In a timeless system (one that is imagined as timeless) there can be no time-lags. We need not go into the metaphysical concept of time but may simply note the fact that time is an attribute of matter which our imperfect mind invests it with. Thus, one could find a way of converting a system that has time attribute into one that is timeless. Our statical analysis treats of a system in a way that divests it of time-attributes.

In simple words, let it be said that all economic processes are time consuming. A process is a process by virtue of the fact that it is conceived of as spreading itself over time. Production, as all acts that can be associated with the supply side of an economy, consumes time and so economic phenomena occur at different moments of time. Due to that changes in an economic system do not synchronise but lag one behind another.

CYCLES AND THE PRINCIPLE OF CAUSATION

When phenomena occur over time the principle of causation comes into the picture. Events of this world are not isolated and unrelated to one another ; they are said to follow one another and when they do *follow* and just do not happen to come after the lapse of some time, they can be said to be covered by the princi-

ple of causation. If A is always followed by B there is every justification for our saying that A is the cause of B In the case of an economy the changes that occur on the demand and the supply sides, when viewed in their time-perspective, can be regarded as causally related One event follows as the result of another event. We invest a certain sum of money or inject it into the economic system and that ushers in a series of changes in the variables of the system. The pumped in money passes from one hand to another and causes so many changes in the various economic values. The principle of causation has of necessity time-attribute for the reason that one event, according to this principle, is said to follow another. Were all the events to occur simultaneously there would be no scope for the operation of the principle of causation Thus, time-lags and the principle of causation are conceptually interrelated

Since cycles are caused by time-lags we can conclude that there is a close relationship of cycles to the principle of causation. It is only because the changes that occur in an economy are considered by us as in the nature of cause and effect that can legitimately be said to lag behind one another Once more, at this stage, let us remember that time is, in its reality, an attribute of matter as space is, and being an attribute it is a creation of the human mind (attributes are what the mind invests a phenomenon with) And for that reason our mind can convert a time consuming system into a timeless one—dynamical system can be so viewed as to appear as a statical system

Time has no natural units; perhaps nothing has Commodities have their physical units but not natural units Through the device of the clock and the calendar we break up what would otherwise be a continuous flow of time into bits and thus creates units of time for our purpose. A minute, an hour, a day, a month or a year can thus constitute a unit of time for us Things can be made at will to belong to the same unit of time or to different units. When they are made to belong to different units of time they can be looked upon as following one another, and, therefore, as causally related. By widening the unit of time the various things can be accommodated in the same unit and, therefore, made to appear as concurrent phenomena. This bears out what we have said above, namely, that our mind can convert a time consuming system into a timeless one. A dynamical system can be

made to appear as a statical system. Could we, therefore, say that there is nothing that is dynamic or static in its own right and that it is the human mind that invests a thing with dynamic or static nature?

TIME-LAGS AND CYCLES

As we have observed, national income cannot remain constant over time for the reason that the determinants of income keep on changing. This change, as we know, may be caused by exogenous factors or by endogenous metamorphosis Endogenous metamorphosis is the attempt of a system that is unstable to regain stability and restore order in its own house. However, with that we are not concerned here.

When national income is changing it does not smoothly travel in any direction. Growth of income that should otherwise be expected to be undisturbed is however disturbed resulting in cycles of rising and falling income. Growth through cycles is the common and almost necessary phenomenon of income generation in an economic system Cycles are caused by, what may be described as, overshooting (and undershooting) of the mark. In adjusting itself to a new situation an economy finds that it has overdone (or underdone) its work. Overshooting of the mark must be followed as a consequence by undershooting of the mark. Downswing (depression) is, therefore, the answer to upswing (boom)—one is the cause of the other.

The cause of overshooting or undershooting is time-lag. Adjustments called for by a change in some determinant of income take time and some forces brought into operation are unable to keep track of other forces. Overshooting and undershooting of the mark manifest themselves in terms of over-investment and under-investment in an economic system as also in terms of over and under consumption. Psychological and technological factors both make their contribution to the phenomenon of overshooting or undershooting of the mark.

Let us now come to the point proper; let us mention some of the indices of time-lag in the operations of an economic system. Cycles as we know are caused by the multiplier and the accelerator. The multiplier is a feature of consumption function. The accelerator is a feature of investment function. Investment of

$\triangle I$ generates income of k times $\triangle I$, k being called the multiplier. But this increase of income does not take place immediately. Income generation proceeds by stages and these are punctuated by time-lags. Investment appears as income at once. This is partly spent and partly saved. When it is spent it becomes income for the economy. In the next round this income is again spent and become income once more. And so the process goes on; at each stage a part of income is spent and that generates further income The final stage is arrived at, theoretically, after an infinitely large number of rounds. In the end of course the initial additional investment must bear the same proportion to additional final income as total investment bears to total income But it takes time—there is time lag involved

Then, there is the accelerator, which in a way is the reverse of the multiplier. While the multiplier increased income as a result of increased investment, the accelerator causes increased investment as a result of increased income or consumption The time-lag involved in the multiplier is, in a way, reversed in the case of the accelerator. Investment in capital-goods is rigid, indivisible, to an extent and due to that money has of necessity to be invested in a lump, which investment continues to serve the productive system for a number of years While in the case of the multiplier income grows little by little, in the case of the accelerator investment increases by a sudden leap and then suddenly stops increasing further It is for this reason that we have used the rather naive phrase that in the case of the accelerator time-lag is reversed If the use of this phrase be permitted we can say that the multiplier and the accelerator (the coefficients in demand and supply equations) play their part in the generation of cycles through the intervention of time-lags

It is also possible to say that time-lags are caused by rigidities We saw that when consumption increases output has to be increased (if inventories are not to be disturbed) and for that more investment is needed. But we cannot, for technological reasons invest what would be just sufficient for a year. We have to invest a sum that would suffice for a number of years. Investment cannot be broken up into small bits, it is therefore said to be rigid. In the same way, if one liked, one could say that it is due to rigidity or stickiness that income increases by stages when investment is increased. May be, one could look upon this phenomenon as

rigidity working in the reverse direction. Be that what it may, our purpose has been merely to show that cyclical fluctuation of income is caused by the operation of time-lags. That does not mean that there can be no explanation of cycles except in terms of time-lags; whatever the explanation time-lag will make its appearance in it.

RECURSIVE MODELS AND TIME-LAGS

Economic entities, as any other entities, can have two fundamental kinds of relationship, namely, of being concurrent or successive (sequential). In the former type there is no time-lag, in the latter there is. If and when two things (or events) belong to the same moment of time they can be, and in fact necessarily must be, preceded and followed by other things (or events). The universe as we know it or sense it is not self-born nor is it unchanging—it is born of some other universe or some state of the universe and gives birth to another universe or another state of the universe.

When we take what we might call the horizontal view of the constituents of our universe we find them as co-existing and when we take a vertical view we find them as successive stages of the universe. In the former case time does not enter into the picture; in the latter it is very much there.

In the models of trade cycles we make our economic system recursive, i.e., we consider things or entities as succeeding or following one another. The values of our variables, in such a system, depend directly on their values in the preceding moment or period of time. Here we rely on the principle of causation—the value of a given variable at any particular time is the cause of its value at the succeeding point of time. The two entities that we are most concerned with in a recursive model are income and expenditure. One man's expenditure is another man's income and vice versa. In the case of a macro economy the economy's expenditure is also its own income. If we have to interpret the recursive system sensibly we have to say that an economy's expenditure at one point of time is its income at the next point of time. It is here that time-lag makes its appearance. For instance, we can say that expenditure takes some time to translate itself into income. In a way, expenditure and income are two aspects of the same thing. *A* expends money by giving it to *B*. So *B* receives it as income at

the same time. But logically speaking one can imagine the act of giving of money (expenditure) preceding that of receiving of it (income) Thus a certain period of time has logically to lapse before expenditure can be conceived of as income Income lags behind expenditure When there is time-lag in the process of adjustment—when a change in one variable takes time to induce a compensatory change in other variables—cyclical change occurs in the end-products (mainly income) of economic processes The cyclical movement, characterised by ups and downs, is due to what has come to be called the cumulative process Effects of a change go on accumulating—there is overshooting of the mark as we have observed earlier

It is possible, however, to convert a recursive into a non-recursive system by the device of changing the unit of time. Suppose for the sake of argument that expenditure is incurred in the first half of the day and it becomes (disposable) income in the second half of the day. If we take half a day as our time unit $E_t = I_{t+1}$ the system thus becomes recursive. If we widen the time unit into a day then $E_t = I_t$, the recursive system is converted into non-recursive one.

When a system is not recursive time-lag, to the extent to which it is caused by the recursive nature of the system disappears and so also with it the main condition for cyclical increase of income But whether we assume half a day or a full day as our unit of time, economic facts remain unaltered But for the purpose of our model it does make all the difference what the unit of time is and whether, therefore, there is an actual or assumed lagging of income behind expenditure It is for this reason that we observed earlier that in a way, and to an extent, growth and cycles are convertible phenomena

NEUTRALISING TIME-LAG

Income never varies according to a set pattern. To an extent income variation is haphazard because it is the result of a large number of forces that operate often independently of one another. Theoretically, however, we can classify the variation of income into the following categories ; (*a*) income that steadily increases, at a constant, diminishing or increasing rate, (*b*) income that steadily decreases, at a constant, diminishing or increasing rate, (*c*) income

that rises and falls alternately but converges to a fixed level, (*d*) income that rises and falls but diverges farther and farther from a fixed level and (*e*) income that goes up and down but maintains a more or less constant deviation from a given trend.

Of the above five types of variation the latter three fall in the category of cyclical fluctuation. Since, as we have explained above, cycles are caused by the phenomenon of time-lags, in all cases of cyclical fluctuation of income there must be the lagging of one variable behind another in the economic system We mentioned three kinds of time-lags that could account for cyclical fluctuation of income, namely, those associated with the multiplier, the accellerator and the sequence of expenditure and income. But the time-lag in the case of the accelerator works in the direction that is just the opposite of that in which the multiplier operates. For that reason the possibility exists of effects of the time-lags being neutralised. And when they are thus neutralised income does not vary in a cyclical fashion in spite of the important factor that causes cycles, namely, time-lag, being present in the system.

So that the effect of the time-lag in the case of the multiplier (time-lag on the demand side) may not be wholly off set by the time-lag in the case of the accellerator (the supply side) there has to be a certain quantitative relationship between the multiplier coefficient and the acceleration coefficient : the marginal propensity to consume (alternatively, the marginal propensity to save) has to be a certain proportion of the accelerator coefficient. When this condition is not satisfied the time-lags, due to the fact that they work in opposite directions, neutralise each other and income increases or decreases without ups and downs.

Cyclical fluctuations of income are also attributable to similar fluctuations in inventories and investment— we speak of inventory-cycles and reinvestment cycles. These cases can be accommodated into those of cycles caused by the acceleration principle. Time-lag is the active factor behind all phenomena that directly or indirectly lead to cycles in national-income path. Due to the operation of lags there is overshooting and undershooting of the mark, as we have observed earlier. Or, what comes to the same thing, there is over-adjustment or under-adjustment of economic variables to a primary change in some sector of the economy.

While lags account for cycles, their effects can be neutralised by the opposite directions in which they operate. But even when

they are not neutralised cycles may still be replaced by growth when income is not assumed to lag behind expenditure This, as we have seen, is possible to do by suitably changing the unit of time relevant to exchange transactions It still remains our fundamental thesis that growth proceeds with ups and downs due to disturbances in the forces that account for growth unless these disturbances cancel out one another or *lags* are cancelled by *leads*

Where income grows, exhibiting no cyclical movements with synchronized expenditure and income, it has yet to encounter a barrier that has come to be labelled 'full-employment ceiling' The accelerator in our investment function is psychological in its nature, though it has its roots in technology Investment cannot increase as revealed by our growth models for the reason that while it may not encounter any psychological ceiling it still may and in actual practice does, encounter physical ceiling Monetary investment has to result in real investment consisting of men and material These, however, cannot be increased at will Their limitation exercises a restraining influence on real investment The accelerator therefore, is affected At the point of full employment of some factors the hitherto fixed coefficients in consumption and investment functions begin to change As the changes gather momentum these coefficients undergo a further change This phenomenon initiates a reshuffling of economic forces that account for cyclical movement of income In brief, the full employment of factors induces those changes in the psychological factors behind the consumption and investment functions, that account for lags and leads of dimensions that turn growing income into cyclically fluctuating one.

CHAPTER 19

COMMONSENSE OF FULL EMPLOYMENT GROWTH RATES

GROWTH OF WHAT ?

AN ECONOMY can be visualised as a system that feeds on inputs and produces outputs. If an economy is progressing or growing it is natural to expect that the outputs will be increasing and, therefore, also the inputs, in so far as output is the result of input. It is not necessary, however, that in a prospering and growing economy all the outputs conceived in their physical units should increase. If all the outputs could be evaluated in terms of or resolved into some one output it must certainly increase when an economy is developing.

The important outputs in terms of which we might measure the progress of an economic system are consumption goods and production goods or capital goods. These are of diverse kinds and so the output of a system is usually measured in terms of its money value. With the difficulties that we encounter in solving the problem of aggregation we are not concerned here. It suffices for us to note that the growth of an economy can be conceived of in terms of its (one or all) outputs.

When we speak of growth we have real income in our mind ; but as that is a heterogenous mixture of commodities of different types, when it comes to measuring income or comparing the income of one period with that of another, we take the money value of real income into consideration. We are, therefore, satisfied with the dynamic state of an economy when its money income is increasing. But the gross or total money income of an economy gives us no precise idea of the welfare of the people. For, welfare howsoever conceived is not only a function of total income but also of the 'distribution of that income' among the people. And since distribution depends to a great extent on employment of factors of production, welfare becomes a function of employment. We expect, therefore, that in a growing economy employment should also *grow* or increase. Thus, identifying growth with in-

crease of welfare we can say that growth in its real sense must mean growth of per capital real income and also of employment of human factors of production. Tliese two, however, are not necessarily consistent with each other. For, while employment of man increases the per capita real income may not increase, And conversely, while per capita real income increases the employment of human resources may not increase. What then do we picture as increasing when we visualise a growing economy ? For most of us—for most model builders—it is the increasing volume of gross or net national product that is the index of growth.

CAUSE OF GROWTH

Real income and real inputs are causally related unless there is an increase of real inputs there can be no increase of real output. The cause of growth (of national income) can, therefore be said to be increased use of factors of production. And, as we have seen in Chapter 9, increased use is a function, along with other things, of an increased supply of factors measured either in their physical units or in their efficiency units. Efficiency depends on a variety of factors, some of which may be called autonomous and others induced. For instance, we may have men are who born more intelligent and capable of doing more work or we may have capital-goods that are technically superior. The efficiency of factors due to the former cause can be called autonomous while that due to the latter may be called induced.

Growth of real income requires, therefore increased use of factors of production and if there has to be a continuous growth there must be continuous increase of the use of factors Such a continuous increase is partly assured by a natural growth of population and partly by an (induced) increased use of organising ability As we have explained in Chapter 9, the required degree of elasticity for continuous growth of real income is possessed only by organisation—the ability of the human mind to exert itself to the required extent to bring about a rational adjustment of inputs to the desired volume of real income.

Growth may be rapid or slow, it may be continuous or halting, but if there has to be growth of national income there must be increasing use of factors of production Population cannot be increased infinitum, nor do we want it to increase continually and

rapidly and, therefore, we have to depend on the possibility of almost limitless increase of organisation that the peculiar nature of this factor permits. In brief, technological changes that the application of science to industry makes possible can be relied upon to keep national income increasing in the long run. That does not, however, necessarily mean that improvements in techniques of production would also increase the welfare of the people. Whether welfare would increase or not *pari pasu* the improvement of the technique of production, depends on the effect of such technological changes on the distribution of income. And the distribution of income depends, at least partly, on the employment of factors of production

FULL-EMPLOYMENT CONCEPT

The above discussion brings the concept of full employment into the picture National income and so also social welfare depend in a large measure on the use we make of available resources. Whether we make the fullest possible use or not depends on a number of factors. Whatever the cause of underemployment of resources, we cannot expect national income to increase when the factors of production are chronically unemployed : for the optimum growth of income there should be optimum employment of factors.

First let us ask what is employment. A man can be employed in an act of production ; there can be no employment in the case of consumption. In order to produce—and in the final analysis it is only utility that is produced—one has to employ oneself. When one is engaged in an act of production one is said to be employed. Since the same activity can be production from one point of view and consumption from another, what is employment from one point of view is not employment from another point of view. Reading a book for the sake of direct enjoyment is consumption and, therefore, the reader cannot be said to be employed. But when a book is read for the sake of knowledge that is needed for some purpose, the reader is said to be employed (in the production-act of reading a book). Employment is, therefore, never sought for its own sake; one employs oneself always for the sake of a remoter end. This end, in so far as it is an end, can be called, or placed in the category of, consumption. One is, therefore, employed in production for the sake of consumption.

The above relationship between production and consumption, with its parallel relationship between employment and no-employment, indicates the fact that there is a sacrifice involved in employment. And this sacrifice is compensated (or more than compensated) by the hope of attaining the end, the consumption of direct utility, the object for the purpose of which employment (in production) is sought

Next comes the concept of full employment. To begin with the simple notion of *fullness* a man is fully employed when he cannot be employed further. But what is the meaning of the word further? One way is to measure the extent of employment in terms of units of time, say, in terms of hours of work. In that sense a man can be said to be fully employed when, during the day or the week or the month he cannot work for a single hour more. His inability to work might be endogenous or exogenous in character, i.e., he may be unable to work more because he has no energy, or thinks that it is not worth his while to do more work, or because he is already working for twenty-four hours or as many hours as are at his disposal for the work under consideration

We are talking in the context of the employment of a single man, we shall later extend the concept of full employment to the case of a macroeconomy. A man, to continue the above argument, is then fully employed when he cannot (or does not find it his worth while to) work for longer hours. Of the two cases, of endogenous and exogenous causes of inability to work more, the second one might easily be ruled out as it is not possible to imagine a case in which a person has no time left for further work. We are left, then, with the case of full employment limit being set by the fact of a man not finding it his worthwhile to work for longer hours In other words, a man is said to be fully employed when a further dose of work does not earn for him sufficient utility to compensate him for the extra work.

If our analysis is correct full employment turns out to be optimum employment. It would be better, therefore, to talk in terms of optimum rather than full employment. However, we may now extend this analysis to cover cases of intensive work also and say that full employment (optimum employment) level is reached in the case of an individual when he finds that working either for longer hours or more intensively is not worth his while. In other words, we interpret full

employment in terms both of extensive and intensive margins.

FULL EMPLOYMENT IN MACROECONOMY

It may be noted at the outset that a true macroeconomy does not and cannot exist in this world. As we have observed elsewhere Robinson Crusoe's economy is the only example of a macroeconomy in the strict sense of the word. In our multi-men economies there is not, and cannot be, that degree of co-operation among the various units of factors of production which is necessary to transform a collection of microeconomies into a real macroeconomy

Keeping this in mind, so that we may not expect more than what is possible to expect in the case of modern-world economies, let us proceed to extend the concept of full employment to cover the case of a whole economy

We shall concentrate only on human resources, including in them tacitly the labour force of a country Since an individual, as we have argued above, should be taken to be fully employed when he has equated the marginal utility of the income from work to the marginal sacrifice of work, (i.e , when he is optimally employed), the labour force of an economy should also be taken to be fully employed when the marginal utility of the income of the working force is equal to its marginal sacrifice from work. But as the working force is not a compact single unit, either in the physical or in the psychological sense, it is difficult to determine marginal utility or marginal sacrifice. We are, therefore, forced to interpret the word full employment in a different and operationally more meaningful way.

Let us, then, say that there is full employment in an economy when each member of its working force is fully or optimally employed The conditions necessary for full employment in this sense are however almost impossible to find in any economy. Rigidities, immobilities, lags and leakages make it difficult for every worker to be fully employed at the same time. The word full employment is, therefore, used in yet another sense in which it has greater practical utility Full employment is defined as that state of the market for labour in which all those who are willing to be employed are able to get employment. In other words, if at any given time and in any given circumstances (wages also given) the demand for labour is equal to its supply employment is said to be

full. This does not, however, ensure that when there is full employment in this sense there will be no unemployed worker in the economy. It does ensure, though, that there would be nobody involuntarily unemployed. The wage and the conditions of work in an occupation may be such as to make some labourers unwilling to accept employment. They are not then regarded as unemployed because they have chosen to be unemployed. They had, however, unhappily to take the decision to remain without work

What is most likely to be found in an economy is excess demand for labour in certain industries and deficient demand in others. The state of full employment is not likely to prevail simultaneously in all industries.

This fact is similar to the one mentioned above—neither all workers nor all industries can enjoy full employment at the same time. And that is due to the fact of rigidities, immobilities, lags and leakages in the economic system What then has one to understand by full employment in the case of an economy? To be very correct, one does not really know what to understand by macroeconomic full employment But in a rough way one could say that when there is full employment (of labour) in an economy there is only marginal unemployment, and what precisely marginal unemployment is one, again, does not very well know. If a small percentage of workers is unemployed there can be some practical justification for calling that situation one of full employment. Let us emphasise once again that difficulties of such a nature have always to be encountered when we are considering problems of macroeconomics.

FULL EMPLOYMENT OF CO-OPERATING FACTORS

As we know production is not possible without the co-operation of all the necessary factors of production For the sake of simplicity let us consider the employment of only labour and capital. The factors organisation and enterprise may be ignored or may be allowed to be absorbed by labour. To produce a commodity, then, we have to use both labour and capital, including in the latter all material things that help us in producing goods. In other words, all material things that are not, or are not treated as, consumption goods are included in capital.

If at any time both labour and capital are fully employed

(keeping the meaning of the word full employment as described above in our mind) every increase in output would need a proportional increase of labour and capital if the coefficients of production are fixed. That is, if the technique of production is not changeable then increased output would need increase of both the factors in the same proportion in which output is sought to be increased. Fixed coefficients of production, or fixed technique or method of production, mean that organisation is qualitatively fixed. A new technique (and of course it is assumed to be more efficient technique) always implies superior organisation.

Coefficients of production, however, are never rigidly fixed. And that is for the reason that organisation is a very flexible factor with almost a limitless potential ability to expand itself. For that reason whenever output is increased there is a scope for a change of organisation leading to a follow-on change in the ratio of labour to capital It is pertinent to ask why it becomes necessary to alter the labour-capital ratio when output has to be increased. The technique of production can be changed at any time: why should an improvement in it wait for the time when output has to be increased? The following points supply the answer.

We assumed that there was full employment of factors of production. If it is felt necessary to produce more, employment of factors has to increase correspondingly. If full employment is full in the mathematical sense such an increase is not possible. But since full employment deos not mean that there is always some scope for employing more labour and capital. That can be done by pushing up the demand for factors by raising the remuneration. Talking in terms of labour, wages can be raised but as that would increase the cost of production, some substitution of capital for labour would be attempted by changing the technique of production. The necessity to lower the cost of production by economising the use of an expensive factor of production *induces* improvement in the technique of production.

In the new situation, then, there would be greater employment of factors of production but their employment would not increase in the same proportion. The cost of production might be higher (though it is possible for it to be lower if the *induced* changes in technique make production very efficient) but then the income of the producers would also be higher due to a rise in the price of the output.

What one could say, therefore, is that when the necessity to increase real products of industries is felt *full employment* can be *fuller* by adopting ways that would increase the mobility of factors. The technique of production has in any case to change to facilitate or make possible a shift from full to fuller employmeat But there is a limit to which this process can be pushed. For, if there is a scope for increasing employment after the full-employment level is reached, there certainly is no such scope after the fuller-employment level is attained For a continual increase of the real wealth of an economy we have, therefore, ultimately to depend on a fuller growth rather than on fuller employment of factors of production.

INDUCED AND AUTONOMOUS GROWTH OF FACTORS

If income has to keep on increasing factors of production must also keep on increasing. The increase of a factor can be either autonomous or induced One could say that autonomous increase is an *independent* variable while induced increase is a dependent variable Or, if the word variable is not considered appropriate in this context, we may replace it by the word phenomenon. Let us take the case of labour to illustrate the point. Population growth is mainly, if not wholly an autonomous, independent phenomenon It is independent in the sense that an increase of income or wealth of a country does not directly cause an increase of population It is not impossible, however, to connect causally the phenomenon of growth of income with the growth of population. But the causal relationship in the case of autonomous growth is the reverse of that in the case of induced growth If population increases first and that leads to expansion of output we say that there has been an autonomous growth of the factor labour If, however, population increases (through increase of birth rate or fall of death rate) as a consequence of increased national income we say that there is an induced growth of labour force

Whether there is a tendency on the part of population to increase autonomously, i e., from within itself (if that expression can have any meaning), is hard to say It has been observed that in the very long run the population of most countries has increased at an increasing rate at first and then at a decreasing rate. thus demonstrating the familiar laws of increasing and diminishing returns. But this fact by itself does not enable us to conclude that since

population growth shows the same pattern in most countries it is to be regarded as an autonomous phenomenon. All that one could reasonably conclude from the logistic curve of population growth is that in most economies the various forces so act together (or react to one another) as to lead to the increase of numbers at an increasing rate in the beginning and then at a decreasing rate.

For purposes of model building it is often assumed that the increase of population that accounts for the growth of labour force is an autonomous phenomenon. Whether national income increases or not, it is assumed, population would show a tendency to increase. In some countries and during certain periods of time, population remains stationary. But such cases may be treated as constituting an exception to the general law of increase of numbers. Moreover, when population stops increasing its stationariness may be treated as an induced phenomenon

While there is reason to proceed, while building a model of a growing economy, on the assumption of an autonomously increasing population, providing the needed supply of labour, is there a similar reason to assume that capital also grows autonomously? At the very outset it must be noted that while labour is in a large measure a Nature-made factor, capital is in the same measure a man-made factor. Does man create capital because he is induced to do so? The answer to this question depends on the precise meaning of the word induced. If inducement is understood in the sense of a cause, the question simply asks whether the creation of capital by man has a cause. The answer is obvious. But that is not the sense in which we use the word inducement in the context of model building. Investment is said to be induced if it is the result of increased consumption or income, or alternatively anticipated increase of consumption or income. When increased income or consumption precedes additional investment, investment is said to be induced: when increased income and consequently increased consumption follow additional investment, investment is said to be autonomous.

Autonomous investment in the above sense must certainly have a cause if the principle of causation is a valid scientific principle. What then, we may ask, causes investment to increase autonomously? Sometimes it is supposed that investment has a tendency to increase at a given, more or less constant, rate in the case of certain economies. And when such a tendency is supposed to

characterise growth of investment it is believed that investment has, what might be called, a built-in mechanism that leads to its growth. Investment growth, in other words, is assumed to be or even believed to be, autonomous in character. Hicks, for instance, relies on autonomous investment of the above type to sustain a given (equilibrium) rate of growth of income.

But whatever might be said about the part that autonomous investment plays in the determination of growth or fluctuation of income, one thing is obvious—investment that results in increased income, but is not caused by it, is due to the ever present aim of reducing the cost of production The human mind is continuously aiming at that but succeeds only in continually introducing technical changes that make production cheaper. Scientific knowledge has to accumulate in a certain measure before it can be applied to industry. That accounts for the peculiar nature of autonomous investment that takes place at intervals and which can be relied upon to provide an explanation of certain features of a growing (with ups and downs) economy

This, then, is the position in regard to full employment of factors in the situation of growth. There is, to an extent, autonomous increase of labour and capital The same forces that take charge of full employment of factors when an economy is more or less stationary, also operate with the same object when an economy is passing through its growth-phase with an increasing available supply of factors of production

When the supply of capital increases (autonomously in the sense explained above) through investment it has a tendency to replace labour to some extent. All inventions or changes in technique are not labour saving or labour displacing but unless an invention tends to do that it cannot continue to be profitable There is a co-operation between man and matter, but man wants to throw the burden of work on matter as much as possible For that reason all inventions and new methods of production must ultimately enable man to pass on the work to capital Full employment of capital during the process of growth is likely therefore, to increase the difficulty of maintaining full employment of labour. It is for that reason that a model of growth makes the postulate of either full employment of labour or full employment of capital. Those that attempt to aim at full employment of both the factors have to encounter enormous difficulties.

FULL CAPACITY GROWTH RATE

Full-capacity growth rate is that rate of growth of income which is consistent with full employment of capital. And here full employment naturally means the full employment of a growing stock of capital.

At the risk of covering the familiar ground once again let us emphasise that income grows, when it grows, because of a fuller or better use of factors of production. We can picture three varieties of growth. First comes the actual rate of growth of income. It is the result of the various forces, both endogenous and exogenous, that act on the productive machinery It is, for that reason, neither patterned nor predictable. The growth may be now positive, now negative; it may be rapid or slow and it may be regular or irregular. Next, there is the ideal or the maximum attainable rate of growth. That rate cannot in practice be achieved because it requires the most favourable circumstances to enable the economic system to make the fullest and best use of all the resources. Were all the resources to be fully and most economically employed we would be able to have the maximum possible rate of growth of income. The actual rate is unpatterned and haphazard and cannot be predicted; the ideal rate cannot be attained in practice. What therefore, can be hoped to be attained or predicted is. what is called, the equilibrium or the warranted rate of growth.

This rate too is one that can seldom be hoped to be realised in actual practice. But it is not haphazard; it is the rate to which the actual rate tends to approximate under certain postulated conditions. It is the rate which when attained continues without a change unless some exogenous force comes in to disturb it. It is, therefore, called the equilibrium rate—it is endogenously in equilibrium.

Let us see what this rate is. Income generation depends more or less immediately on the producer class and remotely on the consuming class. And the amount produced depends on the factors of production employed. And that depends on the investment made by producers. Thus, what income is produced depends on what amount is invested. Less the investment less, other things being the same, is income; greater the investment, greater is income. If income has to be in equilibrium investment has also

to be in equilibrium. In other words, if income has to be constant investment must be constant and if the rate of increase of income has to be constant the rate of increase of investment has also to be constant. We assume, of course, that other things remain the same.

When, we may ask now, will (net) investment or the rate of increase of investment remain constant? The answer that stems from the psychology of investors is simple: it will remain unchanged so long as the producers are satisfied with the sale of their goods. In other words, if the producers find that their expectations have turned out to be correct, if they find that the ex-post investment is the same as ex-ante investment, they would not change their plans and the old rate of investment would continue. This is what is implied in Harrod's famous model and in the models of all those who have taken their cue from it.

Producers want that all that they produce with the help of their invested money should find a market If the whole output is not sold it means that they had over-invested in their plants. In that case the unsold goods add themselves to their investment. If all that the capital-stock *can* produce is sold it means that the full capacity (of the production-plants) is utilised. The growth of income or the rate of growth of income is then said to be full-capacity growth rate. This rate if and when attained would continue undisturbed. Capital, one factor of production, is fully employed when this rate of growth of income is attained.

This is full employment of capital in the sense that whatever capital-goods have been produced for use are *used* to their full capacity. It does not however guarantee that as much of capital-goods as can be *produced* has actually been produced When the full-employment position of capital in this sense has once been reached, because income is growing at the rate that is consistent with it, the producers are in equilibrium, i.e., they do not find any reason to increase or decrease investment. Investment and therefore income remain the same Or, in a growing economy, the rate of investment and therefor the rate of increase of income remain unchanged.

But the position may not be stable—it may be a delicately poised equilibrium. Once something happens to slow down the rate of increase of income or to accelerate it the cumulative process starts and income gets progressively less or progressively more.

That is due, as explained in this book, to the effect of time-lags—the economic system responds after a lapse of time to a stimulus acting on it. This point may not be laboured here Suffice it to note that due to lagged responses in an economic system equilibrium exhibits instability. Neither a retarded nor an accelerated rate of growth of income gets corrected. Instead, income gets reduced or increased more and more.

When due to this process capital remains to some extent unemployed this unemployment goes on mounting. But a time comes when it gets once again fully employed. That happens due to, what we might call, a decrease or stoppage of the birth rate of capital. No further investment is made and the depreciated and worn out capital goods are not replaced. Death rate of capital is not allowed to be neutralised by its birth rate. Man has a greater control over capital than he has over his own numbers. The cumulative fall of income is thus halted and ultimately turned into a rise of income. But for the same reason there now occurs a cumulative rise of income till the ceiling (full employment ceiling) is reached.

Now let us see what the rate of growth of income would be if and when capital stock is growing and its full employment is maintained. If capital is fully employed the income generated in a given period would be equal to what it can generate if full use is made of it. Let us use simple algebra to illustrate this point. Suppose at the starting point capital is fully used. If the stock of capital is denoted by K and its productivity by p then pK is the maximum amount that the existing stock of capital can produce. And if capital is fully employed it should produce that amount and so income must equal it. This is the condition for full employment growth of income.

Suppose the income during the current period (t) is Y_t and if the capital stock has increased the income in the next period ($t+1$), denoted by Y_{t+1} should equal the amount that the increment of capital stock can produce. The increment of capital stock can be put down as $\triangle K$. But this investment can come out of savings of the people out of their income. Hence, if income earners save a proportion s of their income $\triangle K$ would be equal to sY_t. Since the productivity of capital is denoted by p the amount that $\triangle K$ can produce can be represented by $p\,sY_t$.

$$\therefore \qquad Y_{t+1}-Y_t=\triangle Y=p\triangle K=p.sY_t$$

We also know that if investment is increased by a small amount income increases by a larger amount, depending on the savings ratio. If the savings ratio is s as assumed above, an investment of $\triangle I$ would produce additional income of $\triangle I/s$. This is the famous multiplier principle which need not be explained here once again. Accordingly, $\triangle Y$ can be put equal to $\triangle I/s$. Substituting this value of $\triangle Y$ in the above equation we get,

$$\nabla I/s = p.sY_t$$

But $s\ Y_t$ is (equilibrium postulated) equals I_t and therefore the above equation can be put down as

$$\triangle I/s = pI$$

or

$$\frac{\triangle I}{I} = p.s$$

By a short-cut argument, $p.s$ is equal to the rate of increase of income because productivity multiplied by the proportion of income saved is, in equilibrium conditions, equal to the increment of income produced expressed as a ratio of total income Hence, we can say that

$$\frac{\triangle I}{I} = \frac{\triangle Y}{Y}$$

The conclusion therefore is that if capital-goods have to continue to be fully employed income must grow at the same rate as investment That is commonsense indeed. Since income depends on investment, the rate at which income increases must be the same as the rate at which investment increases. But we express this condition in other words by saying that if income is increasing it must continue to increase at the rate at which investment increases if capital-goods have to be worked at their full capacity All this depends on the assumptions which we have made, namely that the savings ratio is constant which means that the proportion of income saved is invariant with income. The other assumption is that the productivity of capital or investment is constant, which means that the ratio of output to capital is invariant with capital (and therefore independent of income). These assumptions are made for the sake of convenience of exposition As a matter of fact the savings ratio and the productivity of capital are not constant and vary with income and investment When this fact is incorporated into our model the solution becomes complicated.

But we are concerned only with the commonsense of full-employment growth rate of income.

FULL-EMPLOYMENT-OF-LABOUR GROWTH RATE

Let us now see how we can determine the rate at which income should increase so that labour may continue to be fully employed. We start with the state of the economy in which the existing labour force is fully employed (leaving a margin for a small percentage of frictional unemployment). Now let population increase. We have seen how the growth of numbers can be looked upon as an exogenous phenomenon and to what extent it can be treated as an endogenous phenomenon. Let us merely note here that population is increasing and we are concerned with the determination of the rate of growth of income that would keep this increasing labour force continuously employed. As before the condition necessary can be thus expressed: The income produced must equal the income that can be produced when all the labourers are employed. Let us express this condition as follows:

$$Y_t = L_t \, p_t$$

Y_t denotes, as before, income of period t. L_t stands for the number of labourers during the same period and p_t for the productivity of labour. We have said that L stands for the number of labourers, but to be more correct L denotes the labour force which is a function of numbers and hours of work. There are two ways in which the number of labourers to be employed or rather needing employment can increase. First, by the increase of population (including in it net immigration) and, second, by labour saving devices. Once we note it, we can proceed using loose language.

If in the period $t+1$ income increases to Y_{t+1} we can denote the condition for full-employment growth rate of income by the equation,

$$Y_{t+1} - Y_t = \triangle L/L \,.\, Y_t$$

Hence,

$$\triangle Y = \triangle L/L \,.\, Y$$

or

$$\frac{\triangle Y}{Y} = \frac{\triangle L}{L}$$

The condition for continued full employment of labour, therefore, is that income should keep on increasing at the same rate at which labour force is increasing. This is, as in the case of full

capacity growth rate, the commonsense of full-employment growth rate. Since, income depends on labour force (capital-goods now being treated as accommodating themselves to the other determinants of income), income and labour are causally related and a variation in one, other things remaining the same, must lead to a concomitant variation in the other. Hence, labour will be fully employed if the income actually increases in the same proportion in which labour force increases.

RELATIONSHIP BETWEEN TWO GROWTH RATES

We have seen that if capital is to be fully employed (if it has to be used at its full capacity) income must increase at the rate at which investment increases. If labour is to be fully employed (subject to the meaning of full employment discussed earlier) income must increase at the same rate at which labour force increases. This is commonsense and, as we have pointed out, this is an over simplified statement as it assumes so many things constant which in reality would not remain constant. Moreover, all that these statements mean is that if there has to be full employment there must be full employment. That sounds silly but that is what it comes to. If capital has to be worked to its full capacity income must increase at the rate that is consistent with the use of capital to its full capacity. And that simply means that capital will be used to its full capacity if it is continuously used to its full capacity.

The mathematics or rather the symbols used might cloak this silly conclusion but in reality we have succeeded only in saying this much—circumstances must be such as to enable us continuously to use to full capacity a growing stock of capital-goods so that there may be no unemployment. And the same can be said of full employment of labour. The question is what is the relationship of one growth rate to the other?

The foregoing analysis warrants the statement that it is possible for labour and capital both to be fully employed if they grow at the same rate. Things that are equal to the same thing are equal to one another. Hence, if the two rates of growth are to be equal to the rate of growth of income they must be equal to each other. This is, again, the commonsense of the relationship between the two growth rates. But it is not likely, nay, it may not be possible

even, for the factors to grow at the same rate. Were the two factors governed by the same law or their growth determined by the same forces, income could increase so as to maintain full employment of labour and capital. But the supplies of labour and capital, to some extent, increase or decrease due to the influence of exogenous factors. That is by itself sufficient to guarantee that the two factors cannot grow at same rate. It is not possible to ensure, therefore that capital-goods and labour force shall simultaneously be fully employed or utilised Theoretically, we can lay down the conditions necessary for the full employment of labour and capital during the process of growth. They are : first, that at the starting point the available supplies of labour and capital are fully utilised. Second, that the increase of these factors, in so far as they are under the influence of exogenous factors, proceeds at the same rate. Third, that the endogenous increase of these factors is dependent solely on the demand for them for production purposes. Fourth, that the coefficients of production are unalterable. If these conditions are fulfilled the two factors will continue to be fully employed, i e., the full employment growth rate and the full capacity growth rate would be the same.

The fourth condition mentioned above cannot be fulfilled for technological reasons. Labour and capital are not only co-operating factors of production, they are competing also. While it is true that one cannot produce goods without the co-operation of both these factors, it is also true that it is possible to substitute, within limits, one factor for another. The coefficients of production are for that reason not unalterably fixed. The motive for the substitution is provided by changes in the cost of employing factors as also changes in the quality and efficiency of factors.

CHAPTER 20

A RESUME OF MODERN THINKING ON GROWTH

CHANGE AND GROWTH

LET US view the problem as follows: Income is increasing or decreasing as a result of the given use of given factors of production. And this use is determined by the decision of producers in the first instance, but finally by the decision (partly autonomous and partly not) of consumers. Thus, we have certain parameters of an economy consisting of the given stock of factors, their given prices as also the given prices of products and given reactions of producers and consumers to changes or expected changes in them. But these are not, in the real sense, parameters for the reason that they are mutually dependent on, and changing in their attempt to adjust themselves to, one another. At any moment of time the factors of production and products are fixed and their prices too are fixed and the way the producers and consumers would react to changes in them are also fixed. But at the next moment all these would change leaving nothing unchanged. And the reason for their change is that all the given forces and factors are not able to harmonise themselves—they are not able to adjust and accommodate one another. We may ask, what is the way in which they can adjust themselves? The way in which they can is determined by the desire of all human units to optimise their position. The producers want maximum net income; the consumers want maximum net utility; the factors of production want maximum net earning. The various forces in operation in an economy keep on changing in their attempt to maximise all these things simultaneously. Once they are all maximised, mathematically and logically, no further change can take place unless some exogenous force intervenes.

For that reason an economy goes on changing because all the maximands are not simultaneously maximised. So the given stocks of factors go on changing, the extent to which they are used goes on changing, prices of factors and products go on chang-

ing, the outputs of various products, services and goods go on changing; the productivities of factors go on changing and, therefore, national income goes on changing And when these change the economist wants to know how precisely they change. Do they change in one direction only or in both the directions and at what rates and how long in one direction and at one rate?

NEED FOR A MODEL

For the purpose mentioned above a model of a moving economy has to be built. We proceed mathematically taking certain given factors and certain unknown factors for the purpose of model building In simple models of a macroeconomy the only unknown is income and the only known factors are the decisions of producers and consumers and the initial income figures of two or more periods. It is assumed that other things on which income depends or the general pattern of decisions depends remain unchanged or that they change in such a way that these decisions are not altered. Thus, we assume that prices do not change (more particularly, wages, interest rates, rate of profit and commodity prices) or we ignore such changes assuming that they do not alter the pattern of decisions. We assume that population does not change and the methods of production do not change (the capital-output ratio does not change) or that they change in such a way that the decisions of producers and consumers are not altered and that all the above changes are the result of the pattern of decisions of producers and consumers operating on the given forces of which no separate account is taken except that due to them a certain initial rate of change of income has come about. In yet other words, it is assumed that the other things that are taken as given or fixed are the only dependent variables of the system and that they are acted upon but do not themselves act on outside forces.

Such a model serves some useful purpose but it is too arbitrary and too artificial to be of much use for the purpose of determining the mode of change of income from time to time. Hence, we construct some more complicated models introducing some more variables, which means only that we recognise the fact that the other factors which we had assumed to be fixed are not fixed and that changes in them are not only the effect but also the cause of changes elsewhere.

FROM SIMPLE TO COMPLEX MODELS

Attempts have been made by model builders, therefore, to incorporate more and more variables in their system. As the most conspicuous result, the decision of producers and consumers (more particularly of producers) is shown as depending on a number of factors. In technical language the investment function and the consumption function (or what comes to the same thing, the savings function) are taken to be functions of a large number of variables.

With the incorporation of an increasing number of variables the complexity of a model also increases, rendering mathematical solution all the more difficult. Whatever that may be our object is to find out how income generation in an economy is likely to behave or to determine the cause or causes of a given type of behaviour of income. If we want to know how our national income changes or fluctuates from time to time or how it will fluctuate in the future it is impossible to know that The actual rate of growth of income can never be determined or predicted because its pattern of behaviour is after all *unpatterned.* Income generation is subject to many unpredictable forces The task is, even theoretically, impossible to perform. We, therefore, let the actual growth take care of itself. There can be no model for it as it is itself unmodelled from our point of view, though it must be modelled from the point of view of God.

We can think of a natural rate of growth or welfare optimum rate as Harrod would call it or the maximum feasible rate as Joan Robinson would perfer to label it. But such a natural rate does not easily lend itself to mathematical manipulation. Natural rate is, in a way, a limited or restricted actual rate of growth.

What is most tractable, however, is the equilibrium rate of growth, Harrod calls it warranted rate of growth. It is the rate of growth of income which would not alter because the producers are in equilibrium and so they do not alter their plans. If the income somehow happens to progress at that rate it would meet with no opposition from the side of producers.

As in other contexts in economics, the equilibrium or warranted growth rate is one that has some stability. And we know that it is only entities that are stable that can be *determined.* The question can be asked whether the knowledge of what the equilibrium rate is and can be of any use for us. For, it would seem, such a rate

is neither the actual rate nor the natural rate It may, however, be maintained that equilibrium rate does still have some usefulness in theory. The actual rate is seldom constant, it varies from time to time. Its fluctuation is, however, round a figure—a figure that is constant or that is changing in an unchanging way.

EQUILIBRIUM RATE—THE NORM FOR ACTUAL RATE

Equilibrium rate is, therefore, the norm for the actual rate. Since the actual rate is determined via the decisions of producers (however changing they may be) it is subject to the influence of forces that tend to bring about equilibrium of the mind of producers. It is for this reason that consciously or unconsciously all the model builders have set themselves the task of determining the equilibrium rate of growth of income even when the notion of natural rate is used for the purpose. Let us emphasise here that what economists determine or can determine is the equilibrium value of an entity. And so also here; they determine the equilibrium rate of growth.

Let us then repeat that all our models attempt to find the equilibrium rate of growth of income. For, it is realised that the only rate about which an intelligent guess can be made is the one which would keep the producers satisfied with their plans. This rate has been given different names—warranted rate (Harrod), equilibrium rate (Kurihara and others), desired rate (Joan Robinson).

We have observed that producers (i.e., investors in the context in hand) are in equilibrium when they are satisfied with their plans. In other words, they are in equilibrium when their actual investment turns out to be equal to their intended or planned investment i.e., when the ex-post and ex-ante investments are equal. And since saving and investment ex-post are equal we can express the above condition of equilibrium in terms of the equality of saving and investment. Remember that we are not using these words in the sense in which Keynes uses them in his *General Theory*. His concepts are ex-post and such concepts are of no use in this context. All models in one way or another have to postulate equality of saving and investment for a solution.

In certain given circumstances the warranted rate of growth of income is consistent with full or near-full employment of

resources. Whether that is so or not will depend on a variety of considerations. In simple models there is no indication of the extent of utilisation of resources. That is because in such models the variables are only income and decision of producers and consumers, i e , we have consumption and production or investment functions with, at times, variable coefficients We can construct more elaborate models with consumption and production equations as functions of many variables. But they defy easy solution

In certain circumstances, as we have observed, the warranted or the equilibrium rate of growth is consistent with full employment. But full employment of which factors? Harrod's warranted rate ensures full utilisation of capital. Domar's model postulates full employment of labour, i e. he assumes, to begin with, full employment of labour and then considers in what conditions it would be maintained. But his condition does not hold (as Kurihara argues) when population is increasing causing unemployment due to scarcity of capital, not due to insufficiency of effective demand.

In this context it might be mentioned that Harrod looks at the problem from the point of view of capital accumulation exceeding population Joan Robinson makes capital accumulation depend explicity on the profit-wage relation as well as on labour productivity. On the other hand. Harrod and Domar make capital accumulation depend on the saving ratio and capital productivity

Growth and cycles are different phases of the same process The process of income variation is viewed as a growth phenomenon by Cassel, Harrod, Domar and others while Wicksell, Keynes, Hayek and Hansen view it as cycle phenomenon An economy like an organism grows unevenly and this unevenness is the cycle. An economy cyclically grows as is maintained by such economists as Frisch, Hicks and Samuelson, till death overtakes it But the economy takes birth again so immediately and in such wise as to make its death remain unnoticed

MATHEMATICAL AND VERBAL ANALYSES

Many great economists have built models of a growing economy or of one in which income is cyclically fluctuating The analysis of some of these economists is mathematical while of others is verbal. The former are forced, as we have said to confine their attention

to some major factors including behaviour hypotheses and a number of parameters, while the latter are able to incorporate in their analysis a larger variety of factors. Both these analyses have their own limitations. Mrs Joan Robinson's able analysis is of the verbal type in the main Some others also have avoided mathematical complications. Such models are interesting and draw our attention to the fact that there are many forces that operate on an economy besides those that mathematical economists incorporate in their models. But perhaps there ends their value.

A word may be said about certain assumptions made by model builders. When income grows so many other things also grow or vary with it, such as interest rates, wages, prices of goods, population, technology of production (i.e., capital-output ratio), the productivity of capital, i e., the natural rate of interest, etc But these factors can be bypassed by allowing them to be absorbed by the consumption and investment functions When we talk of investment we have to make a distinction between induced and autonomous investments. The latter is regarded as an exogenous factor. Hicks makes growth depend mainly on autonomous investment giving thereby an exogenous character to his model.

Kaldor makes the rate of investment a function of the difference between the quantity of capital desired and that existing, which in its turn is a function of income and interest. Naturally, it would be an increasing function of income and a decreasing function of interest.

Kurihara would begin with the fundamental proposition or relationship showing that the equilibrium rate of growth of income depends on the savings ratio and the capital-output ratio, the former itself depending on institutional-psychological complex and the latter on techonological-economic conditions.

As we know the multiplier and the accelerator play a great part in all models of growth and cycles. Their influence on an economy is due to the fact that they are incorporation of lagged responses to stimuli. Be that what it may, as far as the multiplier is concerned Kurihara's analysis makes it the reciprocal of the average savings ratio refering to the capacity-expanding variety while Keynesian multiplier is the reciprocal of the marginal savings ratio refering to demand-expanding variety. One has to remember that investment not only acts on demand but it acts on supply as well. On the one hand, it increases the demand and thereby

fights unemployment where it can be traced to deficient effective demand, on the other, it increases the capacity of the system to increase supply and thereby increases national income and fights adverse conditions in an economy where they can be attributed to lack of productive equipment.

STABILITY

A word may be said about the notion of stability. Much has been written on this question of stability of the growth of income. As is natural the treatment of this subject easily becomes very mathematical. But the notion of stability is somewhat hazy as the word has come to be used in senses more than one. There are three kinds of growth as we have observed earlier—warranted or equilibrium rate, natural or maximum feasible rate and the actual rate. Strictly speaking it is the warranted rate that can be *determined* unless the other rates are treated, or to the extent to which they are treated, as equilibrium rates. The warranted rate is a rate which if attained would keep the captains of industry satisfied and so there would be no endogenous factor that would upset such a rate. If this rate continues it is said to be stable. In theory the warranted or equilibrium rate is always stable in this sense of the word.

But there is another sense in which the word stability has been used. It has its genesis perhaps in Marshall's economics. The warranted rate, though stable in the above sense, may not yet be stable in the Marshallian sense. That is, if something happens to slow down or accelerate this rate it does not tend to correct itself and the rate gets cumulatively more and more upset. Harrod, for instance, discusses this point and in his model the warranted rate of growth is unstable in this latter sense.

Concentrating on the first sense of the word stability we can say that warranted rate of growth cannot continue indefinitely. Although according to the model it can and should continue *ad infinitum* because it keeps the producers satisfied, actually it cannot continue for long as its continuance does not depend only on the mental equilibrium of producers. Or to be more correct, the variables of the system incorporated in the model change in a way for which no allowance is made in the model and, therefore, producers' equilibrium is disturbed. In simple words, the insta-

bility is due to the fact that what are taken to be linear coefficients in the equations of the model are not in reality linear.

In yet other words, the warranted or the equilibrium rate is psychologically stable in the sense that the psychology of producers, operating within the constraints set by the consumption and investment functions, does not interfere with the warranted rate of growth. But this very rate may not be stable. The physical requirements for the continued increase of income at the warranted rate may not be available to the economy. Thus, instability, in the sense in which we are using the word in the present context, can be caused by the absence of required physical conditions and by the variability of consumption and investment coefficients.

Without going into details it can be said that an economy in which income is growing there are many other things that grow alongside it. If it is a fairly advanced economy technology is likely continually to improve. If it is a backward economy population is likely to grow along with its productivity. To have a stable growth of income we need, therefore, not only the Harrodian type of equality of the rate of growth of effective demand and the rate of growth of productive capacity $\left(\frac{\nabla Y}{Y} = \frac{S}{V}\right)$ but also their equality with the rate of growth of population with its productivity. This observation is based on the assumption that the principal determinants of income growth are human beings and capital equipment with their efficiency, determined by technique and the proportion in which men and capital-goods are combined. Of these population and technique are to a great extent subject to changes of an exogenous origin.

In Harrod's and Domar's theories technological coefficients are assumed to be fixed for purposes of analysis. Capital-output ratio, capital-labour ratio and labour-output ratio are taken to be fixed and when they change growth becomes unstable unless when they change in a certain suitable fashion.

WHAT IS MODEL BUILDING ?

Model building is model building, just model building and nothing else. Something is no doubt gained by constructing a model simple enough to let us carry through the mathematical

manipulations to get at the end products. But the danger is that we might forget that it is only *something* that we gain by so doing. A wise economist, even the most intelligent one, has to confess to a sense of disappointment in all such indulgence in exercises in model building For, it is now realised that we have as yet no satisfactory model to explain and account for all that happens in an economy And certainly we cannot have it either and should never expect to be able to have it.

CHAPTER 21

VARIABLES OF A DYNAMIC SYSTEM: EXPLICIT AND IMPLICIT

MACRO-ECONOMY

OUR MODELS are macro-economic models in the sense that our variables relate to the economy as a whole. We ignored, while building our models, the interrelationships between the like units of an economy. We took account of the action and reaction between, for example, income and consumption or between capital-stock and investment. But we did not take any notice of what adjustments take place in the several units of the same variable. In more specific language, we assumed away the action and reaction between one producer and another, one consumer and another, the savings and investment of one unit and those of another, and such other mutual adjustments in the various units of the same variable. We, by so doing, converted our economy into that of a Crusoe economy, a one-man economy.

Such a simplification has many advantages. It enables us to keep our attention fixed on the aggregates of a system; so that while watching how individual units of a variable behave we do not lose sight of what happens to the total quantity of that variable. While this may be a great advantage, and it certainly is, it is at times secured at the cost of some essential knowledge of changes that go on within an economy. Take, for example, the case of monopolistic competition. In the study of such a market situation we have to know how one monopolistic seller competes with another. Unless we know that we are most likely to go wrong in our solution of the problem. The economy of a country is like a congregation of monopolistic competitors of varied kinds of product and service. However, after having paid a good deal of attention to the manner in which individual units behave, economists felt that they should pay some attention to the behaviour of aggregate entities.

VARIABLE AGGREGATES

The models examined in the last few chapters were in terms of a few important macro-variables The variables that were directly or indirectly included in all the models are income, consumption, saving and investment. Some models, as we saw, included capital-stock as another macro-variable The propriety of such an inclusion was also commented upon by us. These variables can be measured in real terms or in money-terms. It is difficult, however, to measure them in real terms. What we, therefore, do is to measure them in terms of their money-value. Money is the rod we employ to measure income, consumption, savings, investment and other variables. But a measuring rod must be constant in length and so we keep our money constant in value In other words, we measure our variables in terms of constant prices, money is treated as a neutral entity, not changing of its own accord ; we allow it to be influenced by other variables but we do not allow it to influence them.

These four important variables are divided between producers and consumers. Producers invest money and get back that money. Consumers earn income which they spend or save Then, in some models capital-stock also is included. We need not repeat here all that we have said about the inclusion of this variable It may simply be noted here that income can be thought of as a flow while capital-stock may be considered as a stock or a store.

While explaining the phenomenon of under-employment (equilibrium) we had an occasion to point out that involuntary unemployment of four traditional factors of production can be caused by voluntary unemployment of money. Such unemployed money becomes a cash-balance. It serves as a shock-absorber, a cushion, for an economy. We can, therefore, include in our model this variable also. In equilibrium cash-balance will become a constant ; but then in equilibrium all other variables becomes static—static in a relevant sense.

Other variables of a macro-economy which one can take account of are factors of production (their supplies), foreign demand and the wants of the domestic consumers. In most models we begin by picturing a state in which these variables do not change. We assume, for example, that population, natural resources and the technique of production (we may also include the state of optimism

or pessimism) remain constant. We assume either a closed economy or what comes to very much the same thing, a state of an economy in which imports and exports do not change from time to time.

And, lastly, we can also take some notice somehow of the level of prices, not only the general price level but also individual prices—changes in relative prices. If we take into account changes in the general level of prices it means that we recognise the fact of money changing independently. Money is often assumed to be neutral, i.e. we suppose that it is a dependent variable, increasing or decreasing in quantity according to the demand for it. Whether that can make any sense for any economy in which the various sectors have different demands for money we do not bother to ask. This is one disadvantage of a macro-economic study. Were all the sectors of an economy homogenous and were all to behave in the same way, perhaps,macro-economic study would offer no difficulties. For, in that case a macro-economy would be just a multiple of a micro-economy.

Over and above the variables mentioned above, there are exogenous variables which we do not regard as variables for the reason that the manner in which they change is not known to us. We take them as autonomous entities; we do not know what laws govern their movements. One can minimise the number of exogenous variables by extending the limits of one's economic system. As we have already explained, by so doing we convert exogenous into endogenous forces.

HOW DO THE VARIABLES VARY ?

All the models recognise the fact that income, consumption, saving and investment vary and the variation of one or more of them causes sympathetic variations in others. The manner in which one variation responds to other variations was considered briefly during the course of our study of some of the models examined in the previous chapters. When we stop to see how the variables vary we have first to conceive of a state in which they are momentarily constant. For, unless we imagine such a state, variations would cease to be variations. A thing varies *from* a position of constancy. We have, therefore, to imagine a situation in which our variables are at least momentarily constant This is only a conceptual device and it involves no violence to theory. We have

to analyse the problems that face us and analysis is a process in abstraction. We can think of a stationary state by abstracting from all variations in the variables

Suppose, then, that our economy has stopped fluctuating or growing Then in that state the inputs are constant Population, capital-stock, natural resources and methods of production are constant. And the quantities of these factors put into the system per unit of time are fixed The outputs of all goods and services are constant. The wants and preferences of consumers are constant so that the amount sold of each commodity and service per unit of time is also constant. The consumers spend the same amount and save the same amount of their constant money incomes every unit of time Investment too does not change. The capital-equipment does not change in quantity or quality Cash-balances with the people remain unaltered Prices show no variations and the general level of prices, therefore, remains constant The quantity of money in circulation does not vary If it is not a closed system that we are considering the exports and imports too remain fixed All the processes repeat themselves all flows and all stocks remain unchanged That is the picture of a stationary economy in which nothing changes.

Now from this position let the economy make a move. Something must change to initiate a movement of the economy, to jerk it out of its stationary position It is for our purpose immaterial where the change occurs It is not immaterial for all purposes, but if we want to see how the variables change it does not make much difference where the change first takes place Let us suppose that people decide to buy more consumption-goods. That may be due to change of fashion or to anything else But people cannot be expected to buy more of everything ; but it may be that they decide to save less and spend more When that decision is taken the demand for most goods rises Can we say then that an exogenous force has begun to act on the system ? If it is endogenous wherefrom has it come ? If an economy is in equilibrium it means that there is perfect balance among the internal forces In such a case we would be contradicting ourselves if we said that an endogenous force has begun to act on the system. We have, therefore, to trace the cause of the disturbance to a force emanating from an exogenous region. If we assume that the system is a closed one, completely cut off from all surroundings, we cannot

even say that the disturbance has been caused by an exogenous factor. If we cannot logically say that the disturbing cause is endogenous to the system and if we cannot say also that it is exogenous to the system how can we account for the upsetting of the equilibrium position?

This consideration makes us realise that there is no system that is free from all exogenous influences. We can imagine an economy temporarily in equilibrium but we cannot imagine it to be cut off from all external influences. Let us then allow some external force to act on our economy and make the consumers save less than before The immediate effect of it would be to raise the general level of prices. Producers would make more profit. To exploit this situation they would plan to increase production and consequently investment would go up. A part of this investment would be financed by utilising their inflated profits. But that would not suffice. For, as the acceleration principle explains, investment has to increase much more than consumption. As we saw earlier this accelerated increase of investment would be determined (ultimately at least) by technology. Whatever that may be, investment would increase more than consumption. Producers would have to borrow money from their bankers. If credit is elastic this decision of producers to increase production would meet with no opposition. More factors of production would be employed. If resources were previously not fully employed this increased demand would not very much raise the prices of productive services. In any case, however, the factor-earnings are bound to rise to some extent. The higher the prices of productive services the greater would be investment.

The income of factors of production having increased, the demand for goods would rise further. A new round now begins pushing up all monetary transactions. We have not indicated here the mathematical relationship between one increase and another. The points we want to emphasise are that an initial increase of demand for goods (caused by an exogenous factor) reduces saving, increases consumption, raises prices, inflates profit, leads to increased borrowing, decrease of unemployment, higher prices of services and, due to the last two changes, greater investment. The next period begins with higher purchasing power and, therefore, with still greater demand for goods.

While this goes on prices of consumption-goods and those of

capital-goods and credit also rise and the rate of interest is pushed up. Thus, all the variables receive and partly absorb the initial shock to the system But while absorbing it they also give further shocks to the system due to the action of the multiplier and the accelerator.

TO WHAT EXTENT DO THEY VARY ?

Once consumption increases all the variables of the system gradually assume higher values. It is these variations that take the system once again to the position of equilibrium. Our models show, however, that in certain circumstances equilibrium (static) is not re-attained The original position of equilibrium is not always stable. However, let us confine our attention to the case of stable equilibrium. Such an equilibrium, when once disturbed, reestablishes itself through changes in all the variables The disturbance is shifted (and also aggravated) till ultimately its incidence falls on all the variables. This shifting is similar to what we find in the case of a tax The manner of shifting and the incidence of a tax vary according to the elasticities of demand and supply of the thing taxed and the nature of the tax itself. In the same way in the case of a disturbance to an economic system (in the present case increase of demand for consumption-goods and decrease of saving) it spreads its incidence according to the relationship between income and consumption, and consumption and investment. The incidence also depends on the nature of the disturbance, i.e. whether it is repetitive or not.

Thus, the extent to which the variables vary and the time they take to vary differ according to the action and reaction between the various forces that bind them together. Suppose, for example, that demand for consumption-goods increases by 100 If the multiplier-coefficient is 5, i e. if the marginal propensity to consume is 80 per cent, and the acceleration-coefficient is 3, i e. if the capital-output ratio is 3 : 1, then the increase of consumption by 100 would ultimately cause an increase of investment by 300. And this additional investment would result in increase of consumption by 1500. This would be the picture in the final analysis, i.e. when the system has adjusted itself to the new situation created by the rise of consumption. In the attempt to absorb the shock the economy creates new forces. All the variables undergo a change

and finally the system comes to a position of rest once again.

With income stabilised at a higher level and investment and consumption raised, the other variables (through changes in which the new position of equilibrium is reached), attain new values. Prices of goods and productive services, the rate of interest, the capital-stock, employment, all find themselves pushed up

VARIATIONS AFTER FULL EMPLOYMENT

Variations in the variables of a system after full employment of resources is attained differ from those before full employment In the former case it is possible to draw upon the reserve of factors of production, in the latter it is not While the employment of factors of production can go on increasing along with the increase of other variables till full-employment level is reached, after that it is not possible to increase employment (using that word in its popular sense). And yet if there has to be increase of real income—if the growth of real income has to be maintained—production of goods and services must somehow increase. And it is in this context that it becomes necessary to bring in technology as a new variable. If we begin with fixed quantities and qualities of factors we can go on increasing employment till all the units of those factors are put to productive use. After that, however, we cannot stick to our assumption of constancy of quality of factors. The only way in which further additions can be made to output in such circumstances is by improving the quality of resources. The easiest way of comprehending such an improvement is to think in terms of the technique of production. Any increase of productive efficiency can be described as an improvement of technique and, as argued earlier, such an improvement can always be attributed to changes in organisation. Organisation is a factor the *improvement* of which can be regarded as *increase of quantity*. The way to measure organisation is not to count the number of organisers—though that can be done in stages before full employment—but to calculate its efficiency as a factor of production.

After full-employment level of output every further increase of income can only come from the improvement of technique of production. And since such an improvement amounts to increase of the factor organisation a pertinent question poses itself at this stage of our enquiry. Do the additional units of organisation

come from an exogenous source? If not, we must imagine the existence of unemployment of organisation. It is possible for external sources to come to our assistance. But to the economies of the world taken together no exogenous source is available The only way then left to us is to recognise the existence of under-employment of organisation For continuous growth of income, which all developed countries are experiencing, there must be an inexhaustible store of unemployed organising ability. There is almost a limitless supply of organisation which an economy is never able fully to utilise.

We may, therefore, believe either that Nature has given us in one instalment an abundant supply of organising ability or that it adds to our limited supply of it according to our need. Perhaps the latter belief is more widely held and is one that conforms closely to our conception of Nature or God as a bountiful agent, coming to our aid in times of difficulty. The manner in which we utilize our organising ability to improve the technique of production does not appear to be governed by any conscious and planned effort on our part Discoveries and inventions are not necessarily made to order. Discoveries in the field of science are more often the result of chance, depending more on inspiration, than on logical processes of reasoning. These speculations about the nature of organisation and the manner in which its supply increases strengthens our belief in the existence of some sovereign power to which we must look for the solution of all our problems.

POPULATION AND TECHNOLOGY COMPARED

Population is another factor that seems to have no maximum limit to its expansion There are thus varying levels of full employment of labour. But labour alone cannot produce anything. With increase of population, true it is, not only does labour force expand, enterprisers and organisers also increase in number. But population never increases evenly at all its strata. Human numbers are notorious for their inelasticity at the top. Thus while our population increases the ratio of labour to enterprise and organisation also increases with it. It is for this reason that we cannot depend on the growth of population for continued increase of national income. If the coefficients of production are fixed the above statement needs no modification whatsoever. And increase

of population cannot change the technical coefficients Such a change requires improved organisation. Hence, if income has to increase continually we have to depend on organisation and organisation alone.

This, then, is the difference between population and technology as means to the increase of income without limit. But there is another difference also which is of interest to us in the present context. Population has a more spacious stomach than organisation. With every increase of numbers the mouths to be fed and stomachs to be filled increase also An organiser too has mouth and stomach, but the capacity of his stomach is much smaller. One organiser can produce food for a large number of stomachs. A labourer's ability in this direction is much more limited. Organisation by its very nature is productive of surplus of income over expenditure Labour is not so potent as a creator of surplus. One Einstein, by his discoveries leading to the production of nuclear energy, can effect a tremendous increase of wealth : but no single labourer can ever bring about such a revolution in the technique of production. In fact it is not his job to revolutionise production-technique. And if a labourer ever does make such discoveries he does so in his capacity as an organiser.

The foregoing difference between population and organisation explains our concern at the rapid growth of human population and our efforts to restrict that growth. Once again it is organisation that helps us to halt the growth of numbers.

CHAPTER 22

THE QUESTION OF CHOICE: STABILITY OR GROWTH

POSITIVE AND NORMATIVE SIDES

KNOWLEDGE IS of two kinds: knowledge of relationship between one thing and another and knowledge of changes in that relationship. In positive economics, or what might better be called the positive study of economics, we seek the former type of knowledge, in the normative study we seek knowledge of the latter type and we seek it with a purpose. To grasp the full significance of this distinction let us analyse the problem in hand

Man is a rational being in the sense that his behaviour is governed by the choice of ends. His actions are not automatic—not of a reflex type—he is not merely acted upon by the forces that surround him. He modifies those forces by his own efforts He anticipates, tries to foresee, the result of his behaviour Different actions produce different results. He makes an attempt to foresee them. Having done that, he makes his choice and accordingly determines his reaction to external forces.

Man can in that way alter his future (So it is supposed) He has his own preferences, he has a future in mind which he wants to guarantee to himself. In short, he can differentiate ends and he can arrange them in order of his preference Having selected his end he makes an effort to attain it The forces acting on him must be opposed, and in some cases sided with, to enable him to march towards his goal This necessitates a knowledge pertaining to the behaviour of forces that make up his environments. He must know how they would react to his opposition; he must also know the manner in which they react to one another. The former type of knowledge depends on the latter. They are the two kinds of knowledge we have spoken of above.

The entire field of knowledge can, then, be broken up into three. The knowledge of the end, the knowledge of how to react to environmental forces, and the knowledge of how those forces react to one another. The first is purely the question of *norm*. Any study

that is related to it is called a normative study The second is a question of *policy*. The third is the question of *positive knowledge*, the knowledge of environments as distinguished from ourselves.

Many of us do not realise that there is some end which we must endeavour (and actually do try) to attain. We are more conscious of our sub-ends which engage our attention all the time. But these sub-ends are not always consistent and unless they are related to one final end there can be no criterion for action. The disappointments of life are often due to our ignorance of the final end We seldom see beyond our nose or think beyond the morrow. A shortsighted person walks blindfolded on the road that lies in front of him. If we have to exploit our rationality to the greatest advantage we must make a conscious effort to find out what it is that we really and ultimately want to achieve. We shall repeat, most of us do not care to open our eyes fully and consequently do not know where our actions are leading us.

In spite of centuries of experiments with the forces of nature we are today where we always were, nay, in terms of contentment and peace of mind we are very much poorer. Without proper examination we decide to march forward on the path to material development. If confronted with a choice between stability and growth we select the latter And why? Are we clear in our mind about the consequences of increasing material wealth? What is it that the acquisition of wealth is calculated to give us? The normative study of our science is faced with the above question.

THE FINAL GOAL

All our actions are directed towards the satisfaction of wants. Satisfaction is one way of removing wants. While the presence of a want causes pain its satisfaction yields pleasure. Pleasure thus consists merely in the decrease of pain. The prerequisite for pleasure is, therefore, pain This negative nature of pleasure is most often mistaken for a positive character and it is consequently believed that satisfaction of wants makes a real contribution to our welfare. In a way it does; but it should not be forgotten that creation of a want with the object of satisfying it (a policy that is frequently recommended) does not result in any addition to our welfare.

Whatever the way of looking at it, the fact cannot be disputed

that a want is an unwelcome intruder. Whether we satisfy it or get rid of it otherwise, it is a thing that all of us want to be without. Wants have to be got rid of, we can get rid of them by satisfying them but that amounts to pampering of wants This mode of removing wants is an abortive one For satisfied wants keep on recurring There is another way available to us of freeing ourselves of wants Instead of satisfying wants we can overcome them. To satisfy a want is to yield to its pressure, to overcome it is to stand up against it. The way to overcome or eliminate wants is to let our noble and sublime wants assert themselves Little by little we can thus free ourselves from the bondage of wants Such a process does not amount to suppression of desires, it amounts to purification and reduction of desires We have to win a victory over our passions and our greed By the satisfaction of wants as and when they arise we intensify our passions and increase our greed Our animal instincts flourish and thrive on the satisfaction of wants

While we thus go on satisfying our wants we, in the process, also multiply them The *multiplier* which we found operating in our economic models operates here also Our income goes on increasing and with that it becomes more and more necessary to have still greater income There is no happy end to such a process. And yet we find ourselves blindly marching forward on the path to accumulation of wealth We vainly look to growth of income to solve our problems; but instead of solving them it only creates new problems for us

POLICY IMPLICATIONS

If freedom from wants is our final end every effort must be made to eliminate wants at the individual as well as social level But a man in his capacity as an individual finds it hard to put his knowledge to practical use His is too weak a force to put up a fight against the insistent pressure of wants and he therefore, yields to temptations more easily than he himself knows he should. And added to this weakness of his is his limited foresight and a short span of life. He scarcely realises that there is a distant future that he must face. He believes in ethical values but does not know that they have their firm foundation in the immortality of man's innermost self. All these facts militate against the adoption of a wise policy in regard to his attitude to wealth

These reflections place a heavy burden on the State making it clear that to give a right direction to human efforts the State must play an increasingly important role. But alas! we look in vain to the State for proper guidance. All over the world the government has been playing into the hands of the *satan* that tempts and misdirects. The vigorous attempt made by all economies to develop and provide means for a luxurious living to its people bears witness to our observations above. The glamour of wealth and the shortlived happiness that accompanies its accumulation blurs our vision and makes peace of mind recede from us like a mirage the more we chase it.

It is the duty of the government to educate the people in the correct way of living, making them realise the futility of trying to reach the end through accumulation of wealth. By the adoption of a well-thought-out industrial policy that involved neither the exploitation of men nor that of natural elements, a government can keep the indisciplined instincts of men in check. Coupling this with a suitably modified system of education a government can hope to accomplish the task assigned to it as the protector of individual interest.

MODIFICATION OF MODELS

If the individuals and the government change their attitude to wealth realising the futility of running after it our mathematical models would either need modification or have to be differently interpreted.

First of all let us see what effect a change in the consumers' and producers' attitude would have on our simple multiplier-accelerator model.

Let consumption be $C(t)=cY(t)$
and investment $I(t)=g[Y(t-1)-Y(t-2)]$

with greed for wealth gone, individual consumers would not care to save beyond a certain amount. With every increase of income the consumption-coefficient would, therefore, rise (due also to charitable transfer of money to the poor). This would strengthen the multiplier-effect, speeding up, other things being the same the rate of growth of income.

With the grabbing instinct gone, producers' attitude would also show a change. They would not take advantage of increased

demand to raise prices to their maximum extent Perhaps of their own accord they would ration out their supplies. With profit thus kept low the inducement to invest would be weakened The rise in money receipts being restricted, the volume of investment would be kept low even if the investment-coefficient itself did not change

The overall effect of these changes would most probably be to accelerate the rate of growth of income, expediting the approach to full-employment level All this for the good of society

In the investment function we sometimes include autonomous investment. Autonomous element of investment is an exogenous factor and some model-builders treat it as a fixed quantity while others make it a function of time That is done to incorporate in their models the effect of periodical application of scientific discoveries to industry. As time passes our knowledge of pure science and technology of production grows, often at an increasing rate, leading to the investment of capital that is independent of any previous increase of income In the new type of society we are considering here, the motive for such investments would be very weak. Scientific inventions might continue to be made for their own sake. But their application to the art of production would be strictly limited to the needs of a growing population.

The effect of all this would be to weaken the sensitiveness of autonomous invention to the progress of pure science In the investment function the coefficient of autonomaus investment would have a small (or very slowly increasing) value. So much about the modifications in the models necessitated by the changed attitude of individuals to wealth Income would grow most probably at a rapid rate but only till the existing resources were fully employed. Thereafter, the inherent powers of organisation would not be exploited further to increase wealth or income

Now come to the macro side of the picture. i. e. the effect on the productive system of government's changed outlook on life. Whatever facilities the govevnment normally provides to private persons for the application of science to industry would be withdrawn And the government in its capacity as a producer of wealth would change its investment policy in the same way as a private producer would. In the models that show government expenditure (investment) separately the same modification would need to be made as in the case of private investments. Public finance would not need to be used as a weapon to secure better distribution of wealth

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